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# EFFECTS OF NONIDEAL SURFACE ON AIRBLAST FROM ONE-MEGATON YIELDS


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This technical report has been reviewed and is approved for publication.

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Hull hydrodynamic computer code calculations were performed of 1-MT surface bursts and air bursts at 500, 750, and 1000 feet heights of burst (HOB). Calculations were performed for both an ideal ground surface and a nonideal surface (with a hot layer of air above the ground surface). The properties of the hot layers of air were defined by a fit to sound speed data from several Nevada events. The nonideal surface burst began to develop a precursor at 1000 psi. All air bursts showed strong precursor effects. The heights of

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20. ABSTRACT (Continued)

burst were low enough to produce "hydrodynamic precursors," due to jetting above the ground, even without a hot layer of air. The addition of a hot layer increased the extent, effects, and duration of the precursor.

# CONTENTS

## SECTION I

## INTRODUCTION

The Airblast produced by nuclear detonations is a primary destructive mechanism. It is imperative from both a defensive and an offensive point of view to be able to predict its magnitude at various ground ranges. Using the experimental data of the Nevada Test Site (NTS) and the Pacific Proving Grounds (PPG), an array of information can be assembled that allows qualitative predictions of airblast. However, the effects of nonideal surfaces upon airblast for large yields would still be unknown since the NTS data are the primary source of airblast modifications from nonideal surfaces. The megaton class devices were done mostly over water at the PPG. Also the NTS data do not include megaton yields.

Then left is the task of theoretically predicting the effects of nonideal surfaces upon the airblast. A surface becomes nonideal when it is not perfectly reflecting. When a surface becomes heated by the thermal radiation of a nuclear detonation, it in turn heats the adjacent layer of air, raising the sound speed. Subsequently, the passing air shock encounters this heated layer and begins to move faster here than in the colder air above, resulting in the formation of the precursor. The fact that this heated layer does produce the precursor was theoretically verified by Ganong and Whitaker (ref. 1). In recent years a great deal of effort has gone into predicting what this heated layer should resemble for different soils and as a function of yield and height of burst (HOB).

Chambers (ref. 2) spent 2 years developing a thermal layer model from first principles. He attempted to model all the relevant physics of the formation of the heated layer through the use of a one-dimensional hydrodynamic computer code. Unfortunately, the number of unknowns and the inability to compare the details of a thermal model with experimental data made the use of the model unsatisfactory. Future experiments may make this approach more viable. In spite of the uncertainties in the model, Chambers did produce a thermal layer model with the use of the one-dimensional code developed while he was at the Air Force Weapons Laboratory (AFWL). A calculation of a 1-MT yield detonated at 1500 feet was completed using this model (ref. 3). Later, Prentice and Ganong (ref. 4), using the techniques developed by Chambers were able to model the thermal layer from a 10-kT nuclear event at 500-foot HOB.

For this study, a thermal layer model has been developed by Ganong (ref. 5). It is basically an analytical fit of the NTS sound speed measurements made above the ground prior to shock arrival versus fluence.* The sound speed data come from several different nuclear events similar in yield.

The theoretical calculations that are reported here are 1-MT yields detonated at HOB of 0, 500, 750, and 1000 feet. Both the ideal and nonideal (heated layer) surface cases are presented so that direct comparisons can be made.

The conversion factors listed in table 1 are included for quick reference.

* Fluence is defined here as the time integral of the thermal energy flux incident to a unit area of ground surface (ergs/sq cm). Flux is defined here as the rate of thermal energy incident to a unit area of ground surface (ergs/sq cm/sec).

Table 1

CONVERSION FACTORS FOR U.S. CUSTOMARY TO METRIC (SI) UNITS OF MEASUREMENT

| To Convert From | To | Multiply By |
|---|---|---|
| angstrom | meters (m) | 1.000 000 X E -10 |
| atmosphere (normal) | kilo pascal (kPa) | 1.013 25 X E +2 |
| bar | kilo pascal (kPa) | 1.000 000 X E +2 |
| barn | meter² (m²) | 1.000 000 X E -28 |
| British thermal unit (thermochemical) | joule (J) | 1.054 350 X E +3 |
| calorie (thermochemical) | joule (J) | 4.184 000 |
| cal (thermochemical)/cm² | mega joule/m² (MJ/m²) | 4.184 000 X E -2 |
| curie | giga becquerel (GBq)* | 3.700 000 X E +1 |
| degree (angle) | radian (rad) | 1.745 329 X E -2 |
| degree Fahrenheit | degree kelvin (K) | $t_K = (t^\circ f + 459.67)/1.8$ |
| electron volt | joule (J) | 1.602 19 X E -19 |
| erg | joule (J) | 1.000 000 X E -7 |
| erg/second | watt (W) | 1.000 000 X E -7 |
| foot | meter (m) | 3.048 000 X E -1 |
| foot-pound-force | joule (J) | 1.355 818 |
| gallon (U.S. liquid) | meter³ (m³) | 3.785 412 X E -3 |
| inch | meter (m) | 2.540 000 X E -2 |
| jerk | joule (J) | 1.000 000 X E +9 |
| joule/kilogram (J/kg) (radiation dose absorbed) | Gray (Gy)** | 1.000 000 |
| kilotons | terajoules | 4.183 |
| kip (1000 lbf) | newton (N) | 4.448 222 X E +3 |
| kip/inch² (ksi) | kilo pascal (kPa) | 6.894 757 X E +3 |
| ktap | newton-second/m² (N-s/m²) | 1.000 000 X E +2 |
| micron | meter (m) | 1.000 000 X E -6 |
| mil | meter (m) | 2.540 000 X E -5 |
| mile (international) | meter (m) | 1.609 344 X E +3 |
| ounce | kilogram (kg) | 2.834 952 X E -2 |
| pound-force (lbf avoirdupois) | newton (N) | 4.448 222 |

Table 1 (cont'd)

| To Convert From | To | Multiply By |
|---|---|---|
| pound-force inch | newton-meter (N·m) | 1.129 848 X E -1 |
| pound-force/inch | newton/meter (N/m) | 1.751 268 X E +2 |
| pound-force/foot$^2$ | kilo pascal (kPa) | 4.788 026 X E -2 |
| pound-force/inch$^2$ (psi) | kilo pascal (kPa) | 6.894 757 |
| pound-mass (lbm avoirdupois) | kilogram (kg) | 4.535 924 X E -1 |
| pound-mass-foot$^2$ moment of inertial) | kilogram-meter$^2$ (kg·m$^2$) | 4.214 011 X E -2 |
| pound-mass/foot$^3$ | kilogram/meter$^3$ (kg/m$^3$) | 1.601 846 X E +1 |
| rad (radiation dose absorbed) | Gray (Gy)** | 1.000 000 X E -2 |
| roentgen | coulomb/kilogram (C/kg) | 2.579 760 X E -4 |
| shake | second (s) | 1.000 000 X E -8 |
| slug | kilogram (kg) | 1.459 390 X E +1 |
| torr (mm Hg, 0°C) | kilo pascal (kPa) | 1.333 22 X E -1 |

* The becquerel (Bq) is the SI unit of radioactivity; 1 Bq = 1 event/s.

** The Gray (Gy) is the SI unit of absorbed radiation.

A more complete listing of conversions may be found in "Metric Practice Guide E 380-74," American Society for Testing and Materials.

## SECTION II

## AFWL SOUND SPEED THERMAL LAYER MODEL

The thermal layer model used in these calculations is empirically derived from a series of NTS nuclear events. The preshock arrival measurements of sound speed were made at different altitudes above ground and at different ranges for events Tumbler 3 and 4, Teapot 12, and Upshot Knothole 9. An analytical fit of the fluence versus sound speed was made using these data. Then, if the fluence at any given ground range is known, the temperature or internal energy is known and the thermal layer is prescribed.

The data from the above NTS events contain temperature as well as sound speed measurements. Temperature measurements represent local values. Reviewing film records of the NTS events (ref. 6) reveals the phenomenon of individual parcels of hot air rising randomly from the ground surface. This effect indicates that three-dimensional effects are important. Further, the temperature versus time records (ref. 7) from Operation Tumbler show a sharp rise to a peak after the thermal energy threshold is met. Then there is a decrease until shock arrival time. Hot parcels of air can be associated with this temperature waveform. Various gauges at the same ground range and altitude show different timing and different peaks for the blowoff. Thus, the temperature measurements would not be meaningful unless they were somehow averaged. On the other hand, the sound speed values were taken over a finite path length and would represent an integrated measure at a given ground range. Finally, these data do represent a direct link to a nuclear case; they are simple and straightforward to use; and their use reproduces within 25 percent the overpressures from the NTS event, Priscilla (refs. 8, 9, and 10).

Figures 1 through 5 are plots of sound speed versus fluence for the five levels above ground surface. A certain amount of scatter is present but a trend does exist. The analytical expression chosen as a fit to these data is

$$C = C_0 + \sqrt{F - F_0} \times \left(A_{1e}^{-\Delta Z/B} + A_{2e}^{-2\Delta Z/B} + A_{3e}^{-2\Delta Z/B}\right)$$

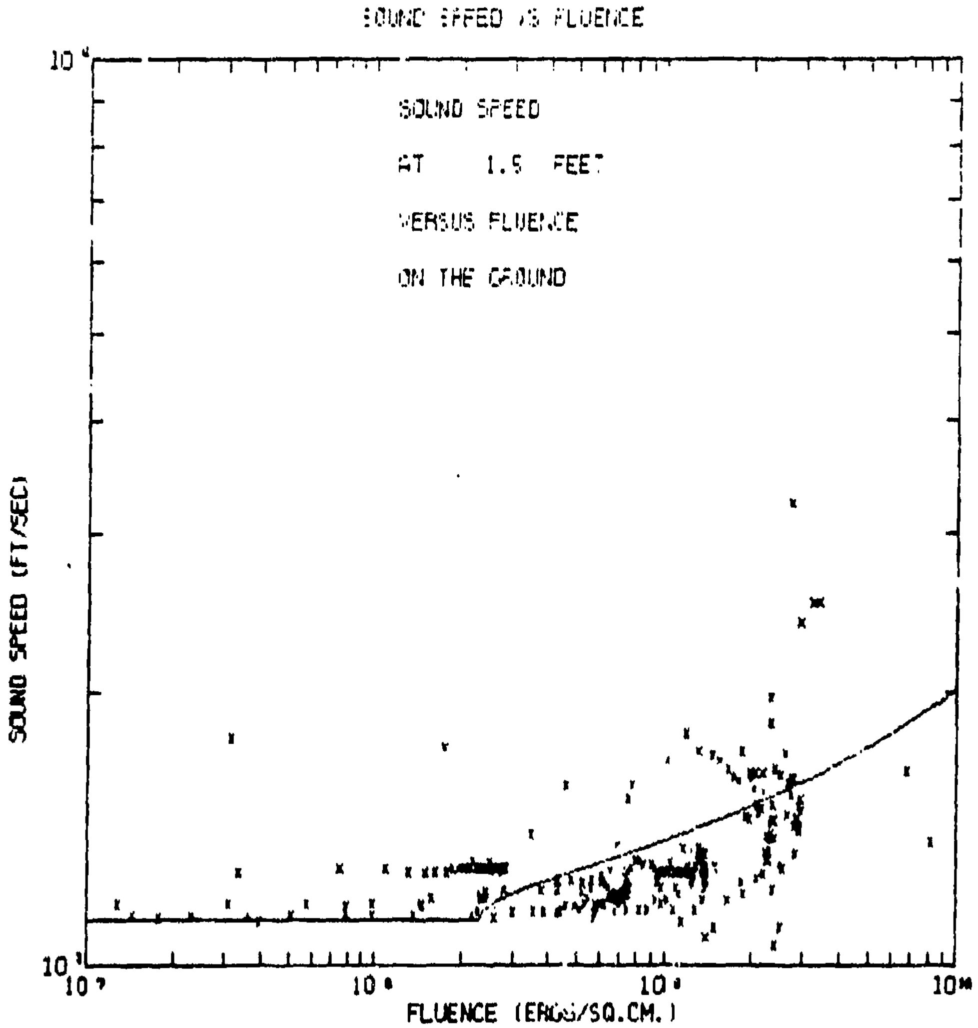


Figure 1. Sound Speed versus Fluence at 1.5 Feet

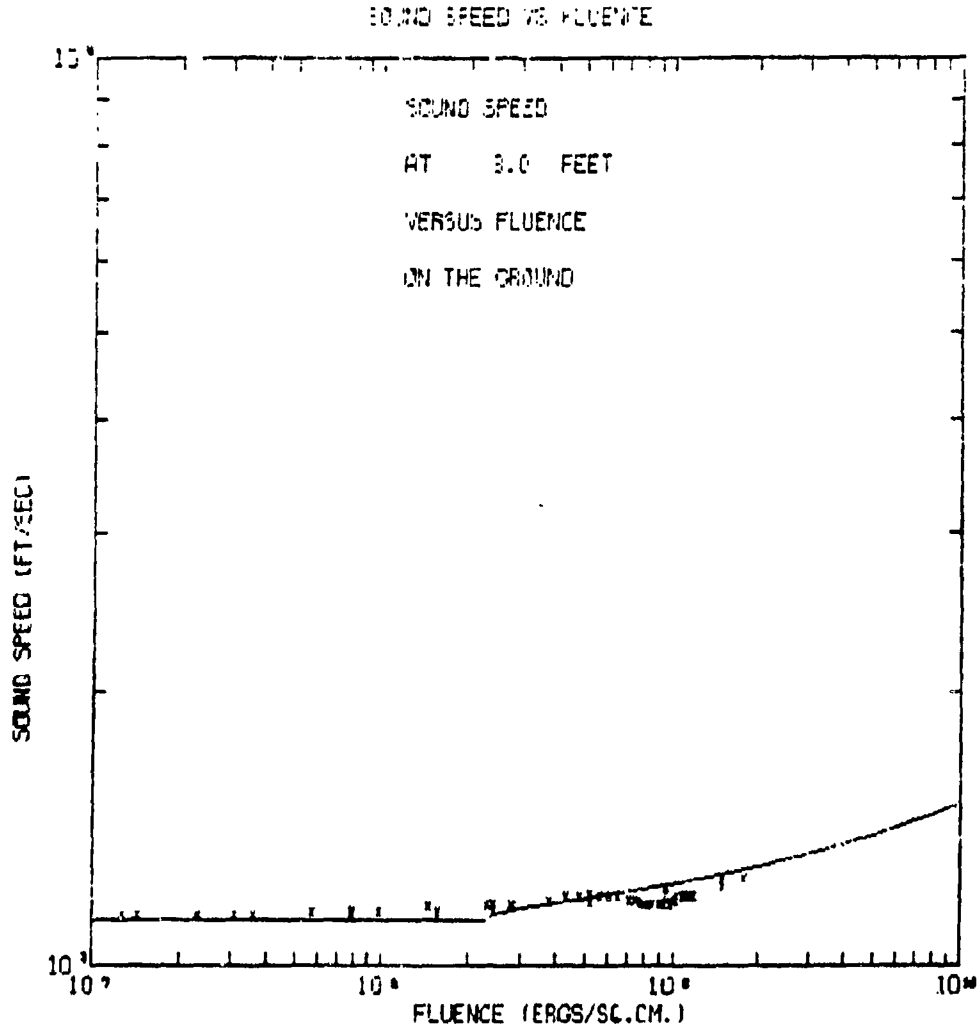


Figure 2. Sound Speed versus Fluence at 3.0 Feet

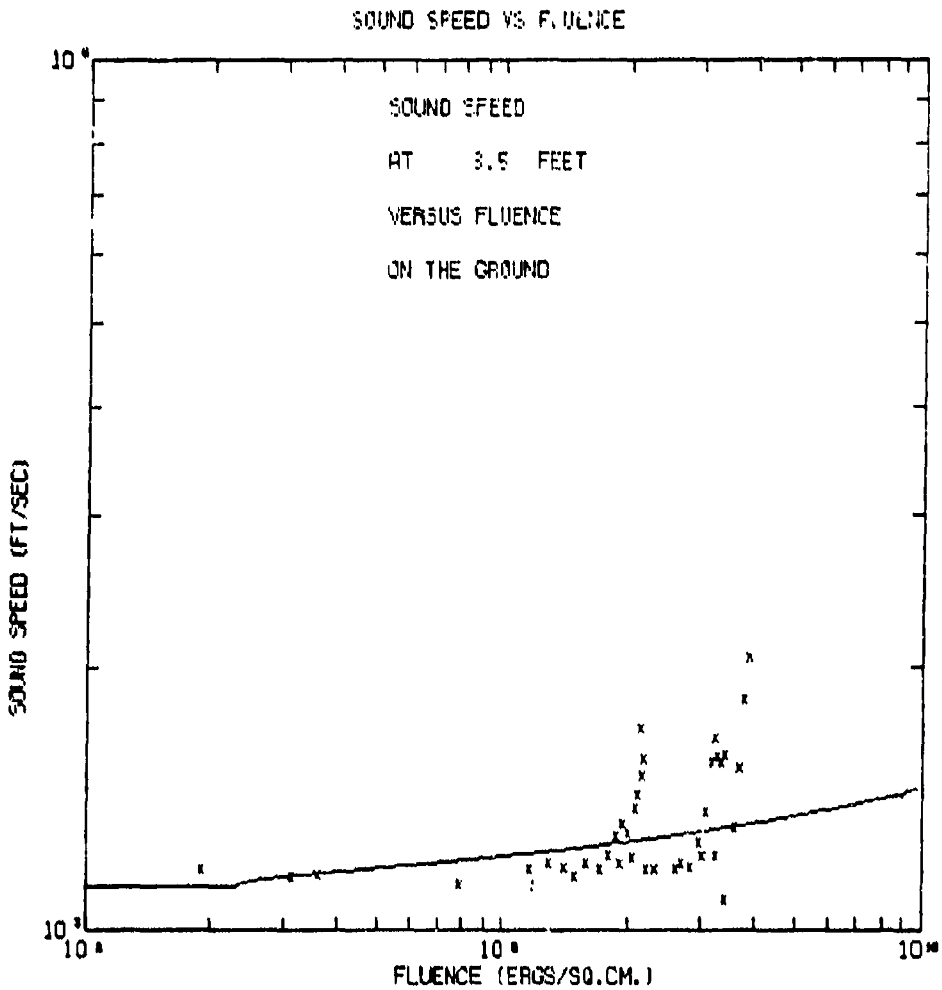


**Figure 3. Sound Speed versus Fluence at 3.5 Feet**

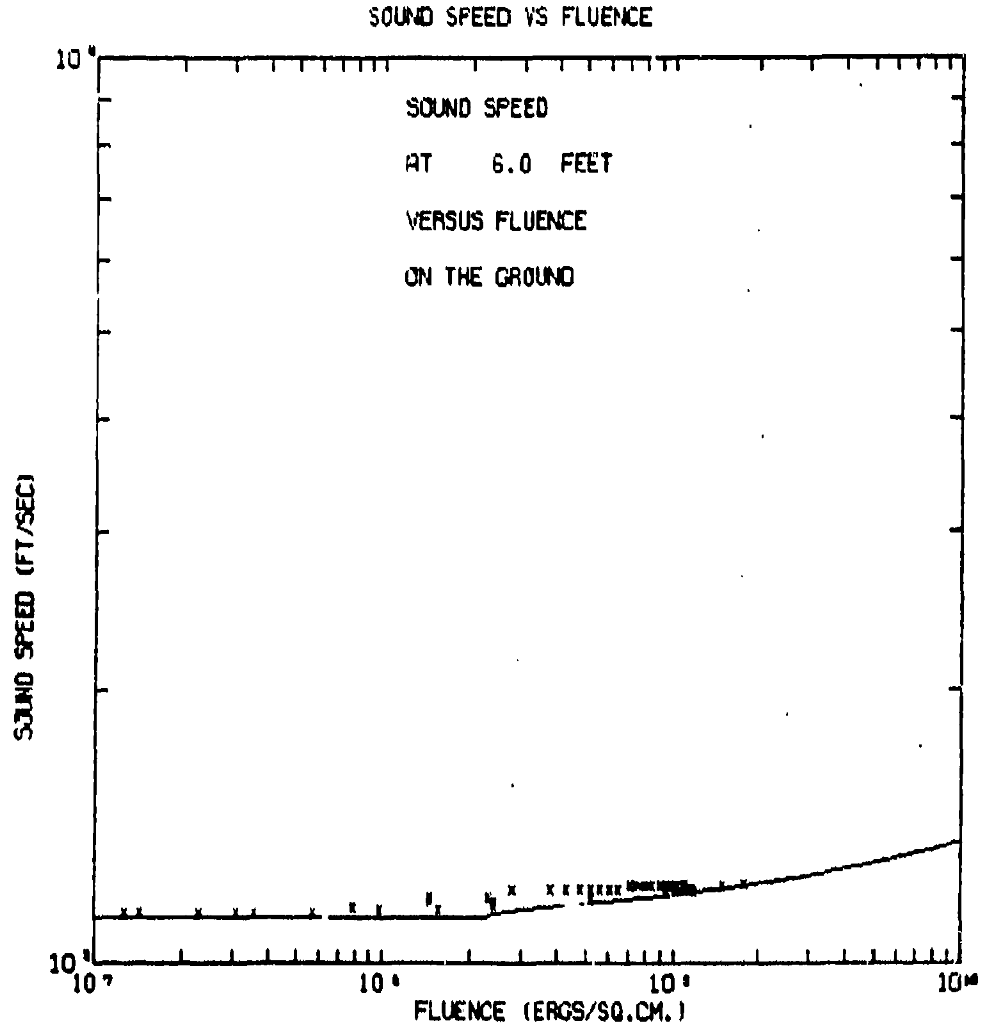


Figure 4. Sound Speed versus Fluence at 6.0 Feet

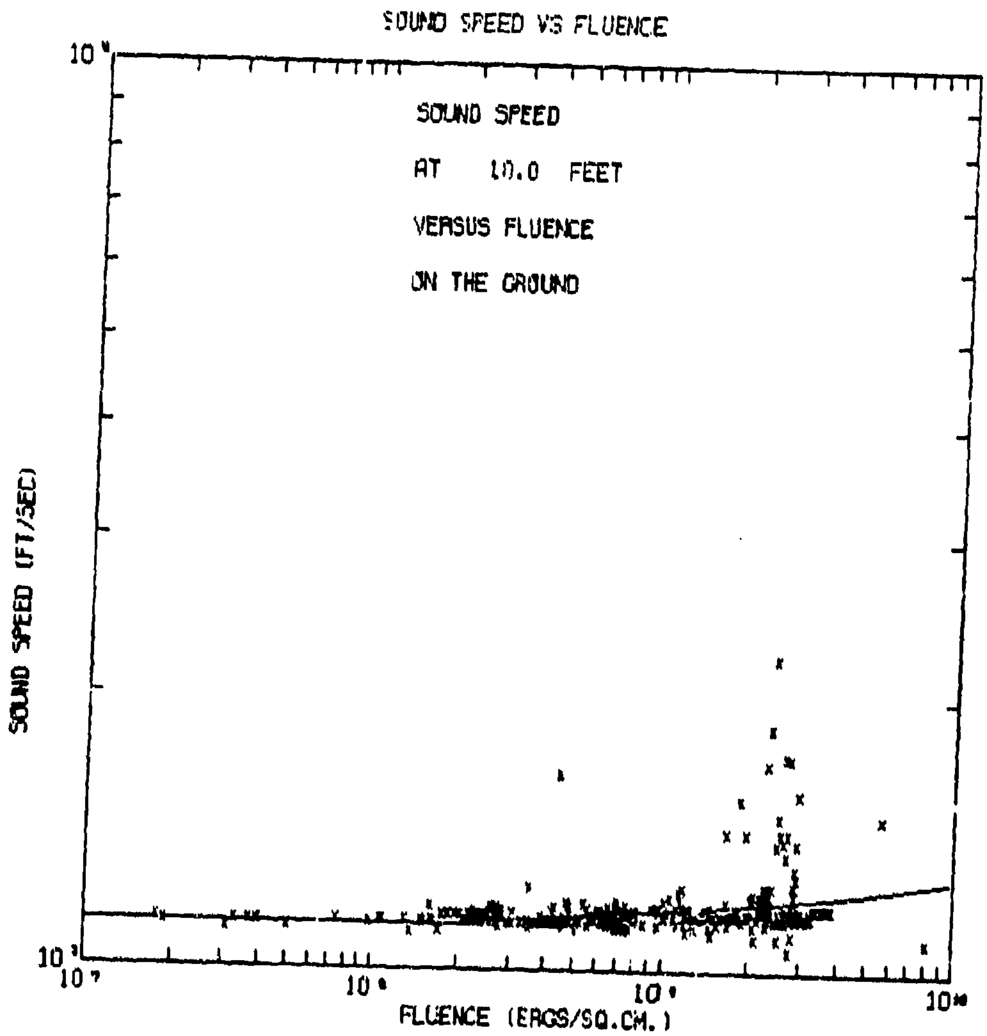


Figure 5. Sound Speed versus Fluence at 10.0 Feet

Here, C is the sound speed in cm/sec at a height $\Delta Z$ (cm) in the thermal layer; $C_0$ is the ambient sound speed; F is the fluence; $F_0$ is the threshold fluence necessary for soil blowoff; and the A's were obtained from a least squares fit of the data. The constant B was arbitrarily chosen as 1.325 meters to allow 90 percent decay of the slowest decaying exponential at 3 meters above ground. If fireball motion is included in the analysis, the following values are obtained:

$$C_0 = 34229 \text{ cm/sec}$$

$$B = 132.5 \text{ cm}$$

$$A_1 = 0.6085 \left(\text{cm/sec/(ergs/sq cm)}^{1/2}\right)$$

$$A_2 = -1.7795 \left(\text{cm/sec/(ergs/sq cm)}^{1/2}\right)$$

$$A_3 = 2.0692 \left(\text{cm/sec/(ergs/sq cm)}^{1/2}\right)$$

$$F_0 = 2.3 \times 10^6 \text{ (ergs/sq cm)}$$

It is physically reasonable to relate the sound speed to the square root of the fluence. The choice of the exponential factors is arbitrary, but does give a reasonably good fit.

In order to investigate the validity of this thermal layer model and compare it to other available models, a series of benchmark calculations was completed. Some of the procedures developed in those benchmark calculations (ref. 11) are utilized here. The NTS event, Priscilla, was simulated using SPUTTER input scaled to 36.6 KT. In addition, because of a series of 10-KT tests done at NTS, a benchmark calculation simulating that generic yield and HOB was done.

The calculation of 36.6 KT at 700 foot HOB gives very good agreement with the experimental data. Both overpressure and dynamic pressure peak values versus range are plotted in figures 6 and 7. The dashed line represents the results from the calculation using the AFWL sound speed fit. As a comparison to this model, the calculation was repeated with the photo fit model developed by Science Applications (ref. 12). The photo fit model obtains temperatures in the heated layer by analyzing the NTS high speed photography. Comparison of the two models shows little difference, although the AFWL model compares better with the dynamic pressure data.

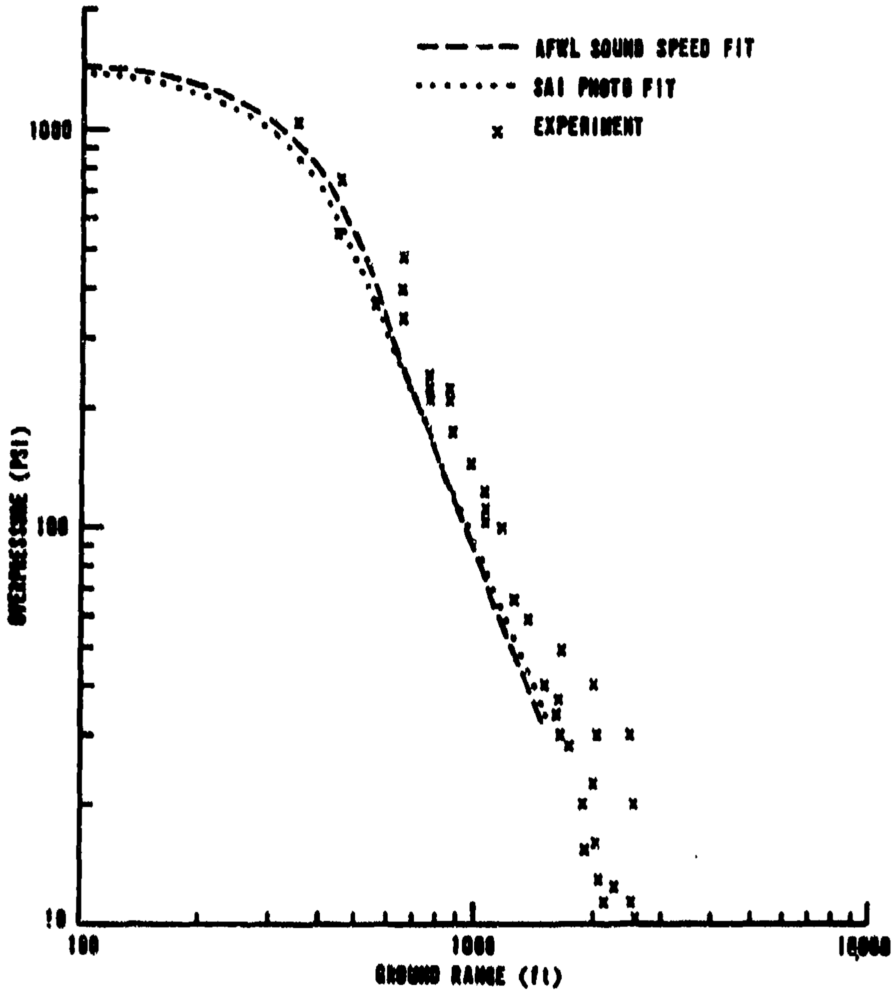


Figure 6. Priscilla Peak Overpressure versus Range

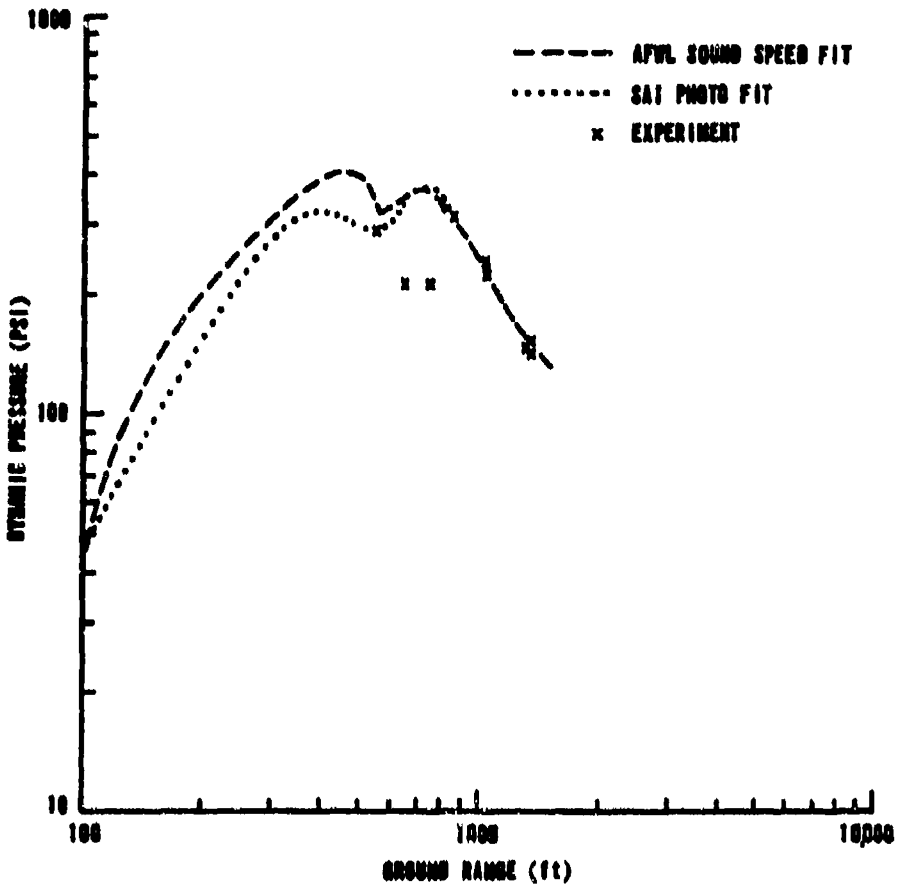


Figure 7. Priscilla Peak Dynamic Pressure versus Range

Figures 8 and 9 are overpressure and dynamic pressure peak values plotted against distance for the generic 10-KT case. The data for this benchmark comes from several events. The legend distinguishes between three events. Agreement between the calculations and the experimental data is fair. Dynamic pressure peaks for both models appear to be high compared to the data, but the AFWL sound speed fit has the best agreement.

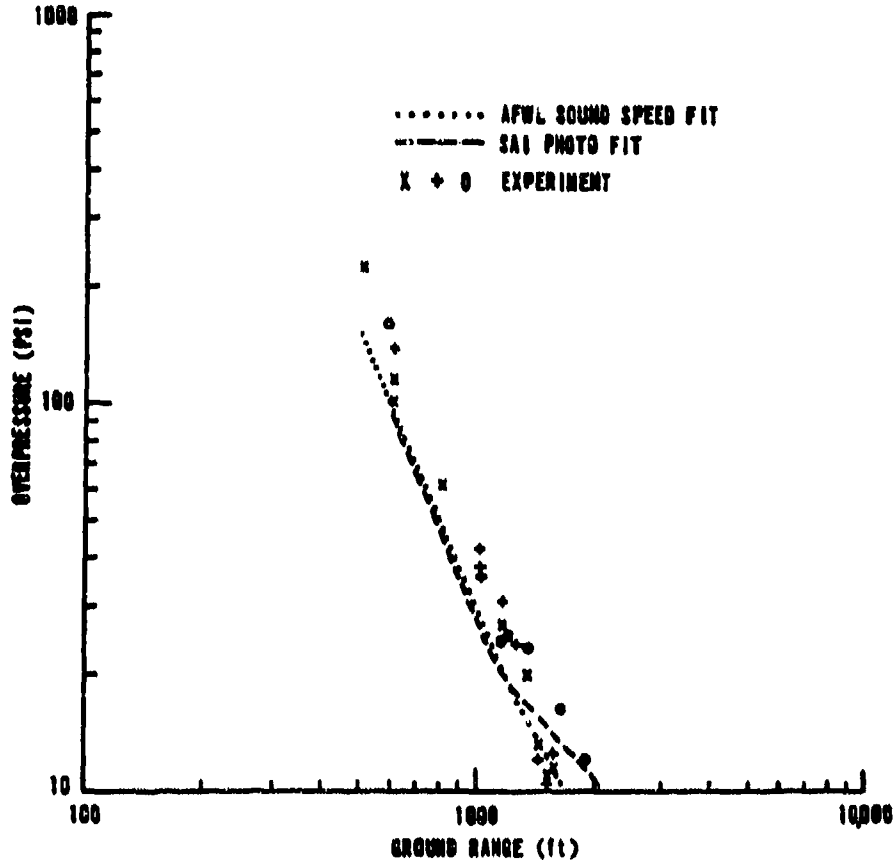


Figure 8. Peak Overpressure versus Range for 10 KT at 500 Feet HOB

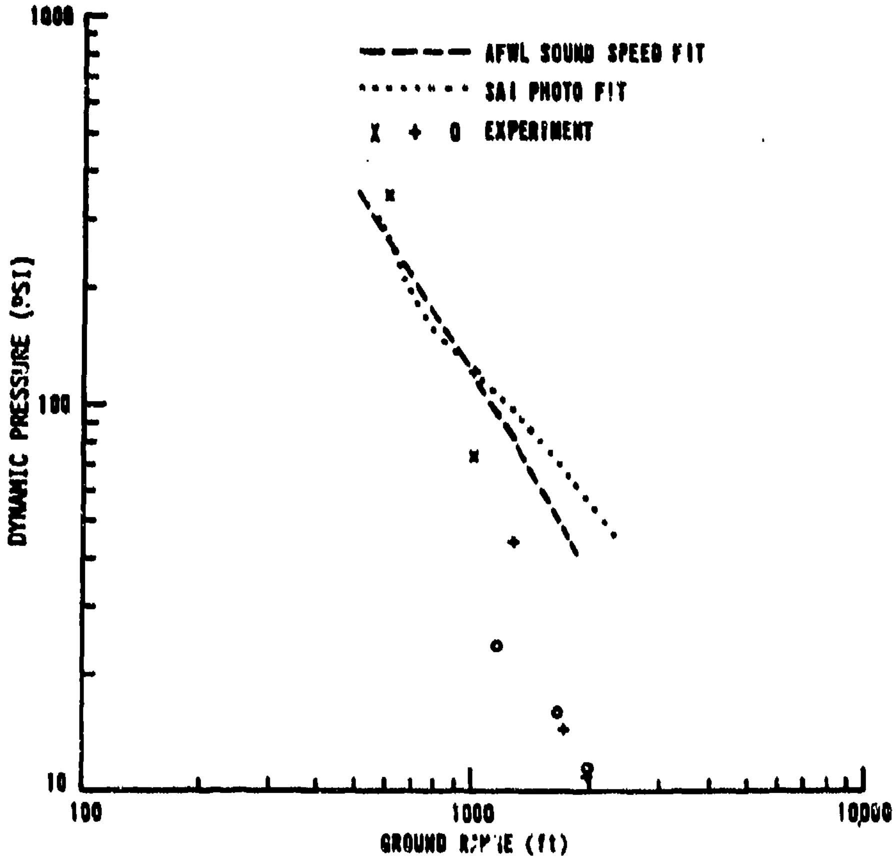


Figure 9. Dynamic Pressure versus Range for 10 KT at 500 Feet HOB

# SECTION III

# COMPUTATIONAL TECHNIQUES

## GENERAL

The AFWL HULL code (ref. 13) was used for the calculations reported here. Initial conditions were provided by results from one-dimensional SPUTTER calculations (ref. 14). The SPUTTER calculations represent the early-time part of the nuclear detonation and solve the radiation transport equation as a function of time. For the calculation of this study, a new rezone technique was devised to finely zone the area of the precursor, and an algorithm was created to account for the size of the fireball as a function of time

All of the calculations reported here utilized similar zoning. The approach was to zone coarsely, that is, to require zones in the region of the precursor to be initially 1 to 3 meters in length. Outside that region, variable zoning was used. Table 2 presents zone configurations for the calculations. Figure 10 indicates typical initial zoning. Initially the zones are all of equal radial size ($\Delta X$ = 2 meters typically). The vertical zone size, once it is set, remains constant for the entire problem. A typical vertical zone size will be 60 cm in the first few zones near the ground and then the size will gradually increase by a factor of about 1.05 for the rest of the zones.

Table 2

ZONE CONFIGURATIONS FOR CALCULATIONS

| HOB (ft) | 1 MT YIELDS No. Zones (X) | No. Zones (Y) | Vertical Zone Size at Ground (meters) | Vertical Zone Size at HOB (meters) |
|---|---|---|---|---|
| 0 | 120 | 120 | 0.6 | 0.6 |
| 500 | 120 | 164 | 0.6 | 2.2 |
| 750 | 120 | 196 | 0.6 | 2.7 |
| 1000 | 120 | 190 | 0.6 | 3.0 |

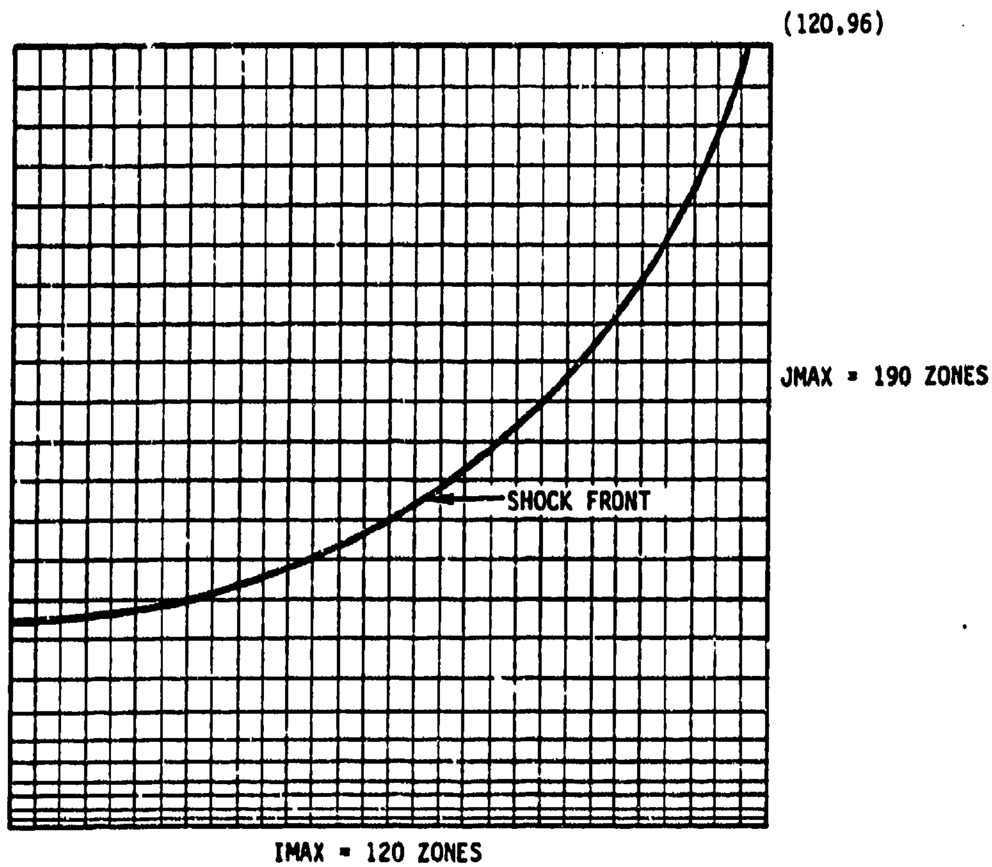


Figure 10. Typical Initial Zoning of Lower 96 Layers of Mesh, Showing Every 4th Zone Boundary

## INITIAL CONDITIONS

SPUTTER 1-D calculations were used as initial conditions for both the benchmark and the megaton yield calculations. The SPUTTER calculations were chosen to best represent the yield and HOB. They were then scaled to the appropriate values. The scaling laws used are

Radius

$$r_2 = \left(\frac{P_{01}}{P_{02}}\right)^{1/2} \left(\frac{W_2}{W_1}\right)^{1/3} \cdot r_1$$

Pressure

$$P_2 = \frac{P_{02}}{P_{01}} P_1$$

Time

$$t_2 = \left(\frac{P_{01}}{P_{02}}\right)^{1/3} \frac{C_{01}}{C_{02}} \left(\frac{W_2}{W_1}\right)^{1/3} \cdot t_1$$

Density

$$\rho_2 = \frac{\rho_{02}}{\rho_{01}} \rho_1$$

Velocity

$$V_2 = V_1$$

where

r = radius from detonation

P = static pressure

W = yield

t = time

C = sound speed

ρ = density

V = velocity

The subscripts 0, 1, and 2 refer to ambient conditions, event 1, and event 2, respectively.

For Priscilla, SPUTTER calculation FB14 was used. FB14 was a 30-KT, sea-level burst scaled to 36.6 KT at 3778 feet above sea level. (Ground level was at 3078 feet.) The 10-KT cases used FB14 at seal level. It was scaled to 10 KT at 3578 feet above sea level. For the megaton calculations FB10 was used. It was a 3.8-MT case at sea level and was scaled to 1 MT and to the appropriate HOB. Different starting times were used for each calculation. At the surface and as the HOB increases, larger starting times can be used. The starting times are detailed below.

| 1-MT-Burst (ft) | Starting Time after Scaling (msec) |
|---|---|
| Surface | 38.3 |
| 500 | 4.15 |
| 750 | 10.3 |
| 1000 | 12.2 |

Since the input is one dimension, then horizontal histograms of density, specific internal energy, and radial velocity at the HOB will suffice to describe the source completely.

REZONE TECHNIQUE

Since the conditions of the shock front along the ground are of interest, adequate zoning in that region is required. Furthermore, the number of computation zones should be minimized to reduce computing costs. What has been developed (ref. 15) is a rezone in cylindrical coordinates that looks for the maximum dynamic pressure $\frac{\rho v^2}{2}$ along the ground. The method adopted requires constant zoning on each side of that peak and then increases each outward and inward zone by 5 percent of the former zone size. Zoning in the azimuthal direction remains fixed, but is close to the constant zone size of the shock front in the radial direction. Increasing zone sizes of approximately 10 percent is allowed above the HOB. Figure 11 indicates the typical zoning obtained by this rezone.

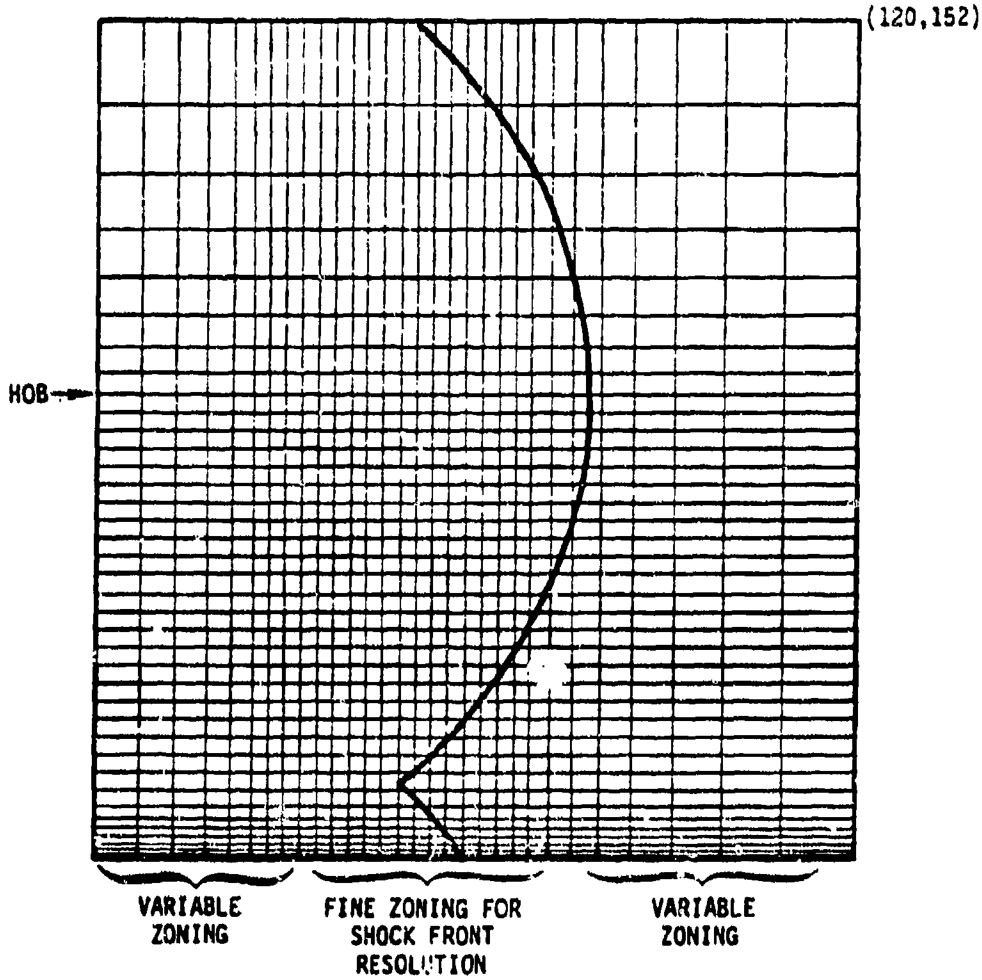


Figure 11. Typical Zoning, in Lower 152 Layers of Mesh, Produced by the Rezone Technique

## FIREBALL SIZE AND FLUENCES

One of the important considerations in determining the value of fluence used at specific ground ranges, particularly those close to the fireball, is the physical extent of the fireball. Assuming, for simplicity, that the fireball shape is sperical and the energy passing through the unit area of the sphere is constant at any given time (only its radius changing with time), the radient energy onto the ground can be integrated to obtain the flux.

Furthermore, for the zero HOB case, a hemisphere is assumed for the fireball shape.

The expression for the flux upon the ground is defined as

$$F = \int \vec{\Omega} \cdot \vec{n} d\omega$$

where according to figure 12

$r$ = range from center of burst

$R$ = radius of fireball

$\vec{n}$ = unit normal to ground

$\vec{\Omega}$ = radiant energy vector or intensity vector

The case for the surface burst is drawn in figure 12a while figure 12b indicates the HOB case. For the surface case, that is HOB = 0, we can derive the flux incident upon the ground in the following manner.

$$\text{Flux} = \int \vec{\Omega} \cdot \vec{n} d\omega$$

Then by identities

$$\text{Flux} = \int I_o \text{Sin}\ \theta \cos\phi\ \text{Sin}\ \theta\ d\theta d\phi$$

The integration is from

$$\phi = -\pi/2 \text{ to } \pi/2$$

$$\theta = 0 \text{ to } \theta_{max}$$

where

$$\theta_{max} = \text{Sin}^{-1} \left(\frac{R}{r}\right)$$

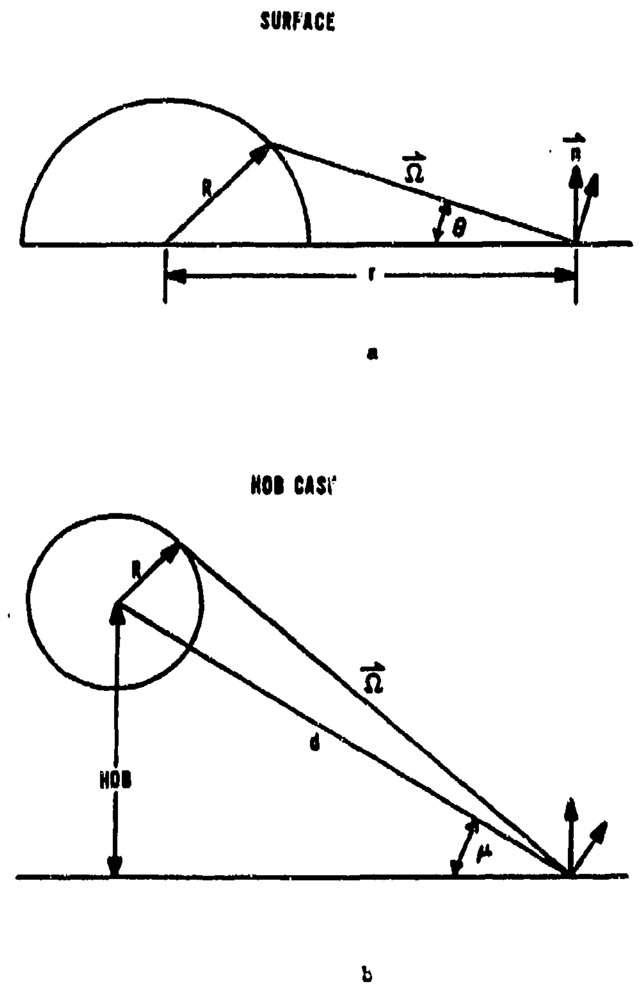


Figure 12. Geometry for Deriving Incident Flux

Performing the integration, the result is

$$\text{Flux} = 2I_0\left[\frac{\theta_{max}}{2} - 1/2 \text{ Sin } \theta_{max} \cos \theta_{max}\right]$$

or

$$= I_0\left[\left(\text{Sin}^{-1} \frac{R}{r}\right) - \frac{R}{r}\sqrt{1 - R^2/r^2}\right]$$

For the case in figure 12b, a point source is simply assumed. As long as the fireball sphere does not touch the ground, this source is equivalent to a spherical source. That is

$$\text{Flux} = I_0 \frac{R^2}{d^2} \text{Sin } \mu$$

wherein $\mu$ is equal to the angle formed by d with the ground.

After determining the flux, the fluence at the pertinent ground ranges for the particular device yield and HOB must be obtained. An important part of this procedure is a FORTRAN subroutine FBLOSS which provides the amount of energy radiated by a fireball as a function of time. This routine was developed by Sharp (ref. 16), who analytically fitted the data from the SPUTTER calculations. Further, knowing the radius versus time of the fireball (ref. 17), one can solve for the intensity of the fireball. Then the desired fluence may be obtained by integrating over time.

In this procedure, the effects of the fireball motion are neglected. The fireball will begin to rise due to buoyancy effects, and its effect on the fluence upon the ground may be important. To investigate this possible modification of integrated flux as a function of time and ground range, the fluence for both cases was computed. One case is a fixed fireball at the HOB; the other one rises. The rise rate for the latter was obtained from a two-dimensional calculation done with very coarse zoning. Particles were placed within the radius of the fireball; and since the particles are constrained to move with the flow, their average altitude at any time is a good representation of the fireball altitude. Figure 13 indicates the results for the 500-ft HOB case. Fluence versus ground range is plotted for different times. At 0.14 sec and a ground range of 655 meters, the difference is about 30 percent in fluence. However, significant shock arrival times center around 0.10 sec. These arrival times correspond to a radial distance of 500 to 600 meters. For MX designs, the ground range at 600 psi is of interest. The free-field ideal ground range is

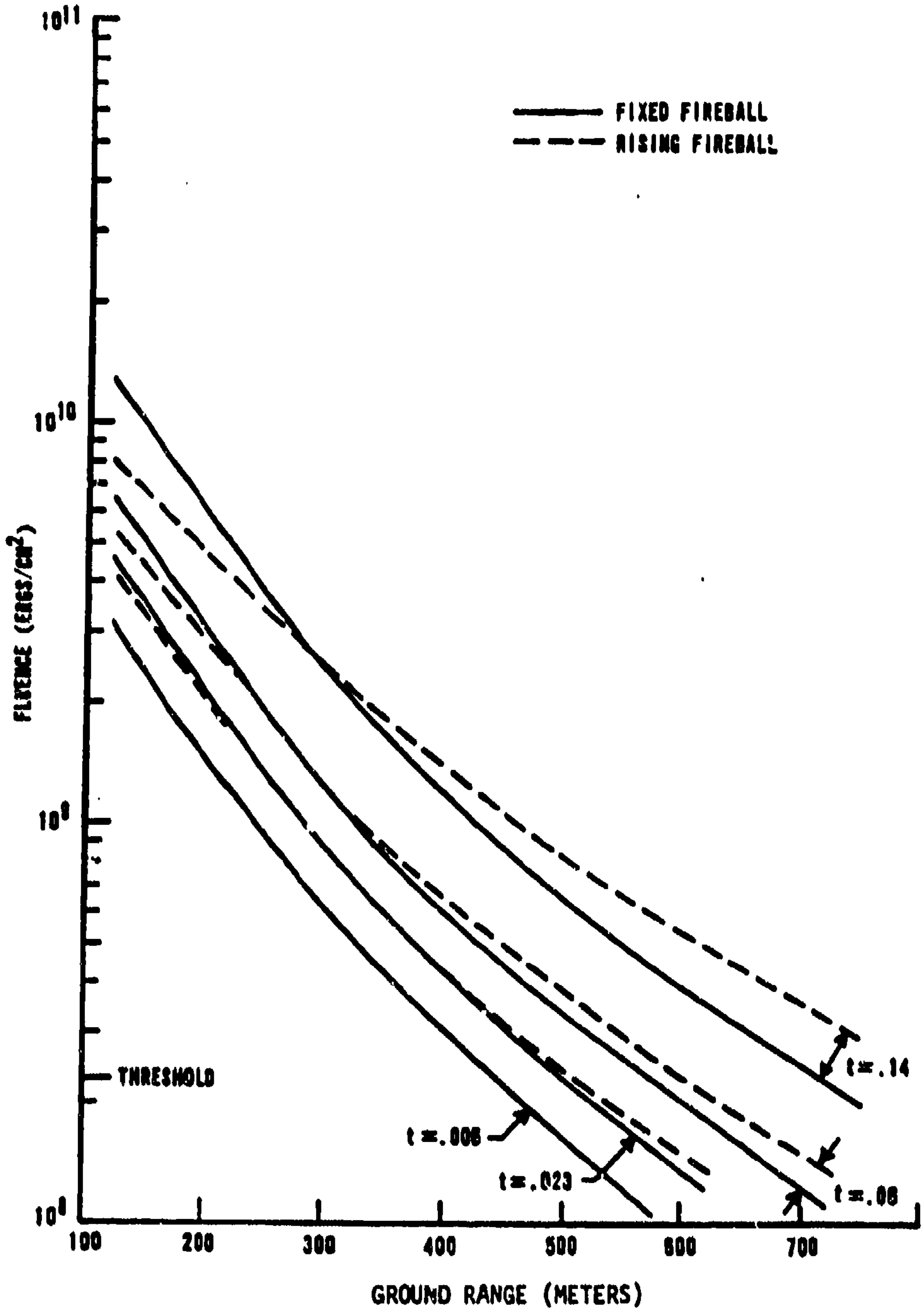


Figure 13. Fireball Fluence versus Ground Range

approximately 540 meters for the 600-psi pressure level from a 1-MT surface burst. At 0.124 sec and 609 meters ground range, the difference is approximately 20 percent. This value grows to 33 percent at 0.154 sec and 731 meters ground range.

In order to examine this effect at shock arrival time, the fluence versus ground range at shock arrival time has been plotted in figure 14. The differences begin at 300 meters ground range, but for distances less than 500 meters, the difference is less than 10 percent.

If the effect of the rising fireball had been included, it would have increased the fluence at larger ground ranges and extended the duration of the precursor effect. For a burst at 500 feet above the ground, the effect is at most 30 percent in the fluence before the shock arrival times of interest. After that time the heated layer is turned off and no further energy is added.

At the other end of this parameter study (the 1000-foot HOB), less effect from the rise of the fireball is seen. Figure 15 compares the rise rate for the 500- and 1000-foot HOB cases. The figure shows that the latter rises less during the same time than the 500-ft case. The net result is to minimize the difference in fluence upon the ground between the fixed and rising fireballs at later times.

As mentioned above, the algorithm for determining the fireball radius as a function of time comes from the 1-KT standard. The form is written for 1 KT as

$$R_{1KT} = 2.5684 \times 10^4 \times t^{0.385}$$

for

$$0 < t < 0.265 \text{ sec}$$

and

$$R_{1KT} = (1.0 - B \times t^C) \times (D \times t + E) + 500$$

for

$$t > 0.265 \text{ sec}$$

where

$$B = 0.03499$$

$$C = -1.068$$

$$D = 33897$$

$$E = 8490$$

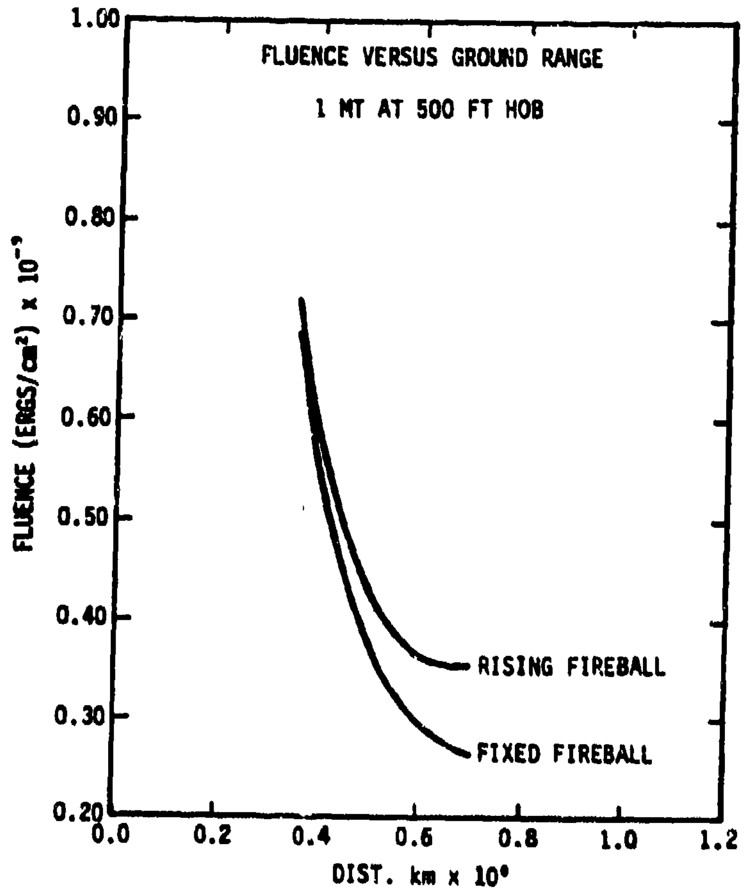


Figure 14. Fluence at Shock Arrival versus Ground Range

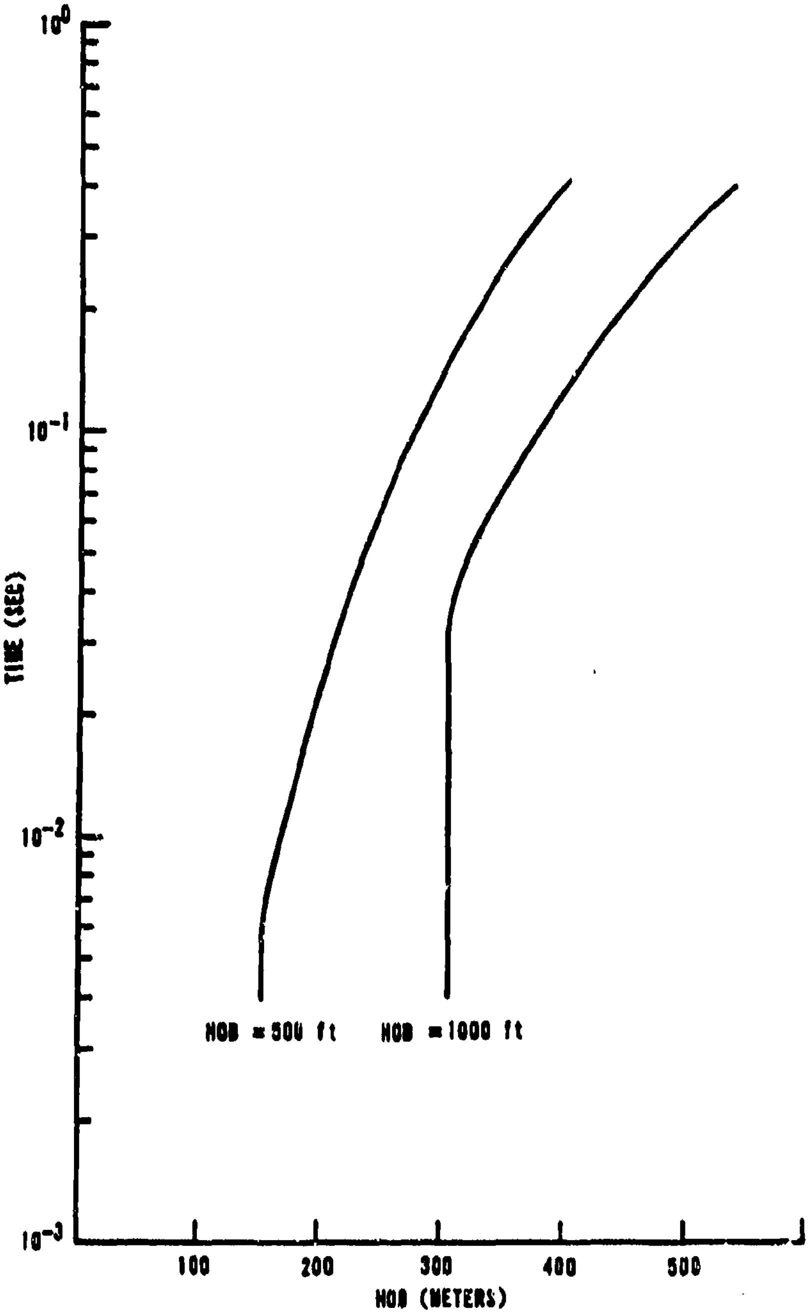


Figure 15. Height of Fireball Center versus Time

The time must first be scaled as follows:

$$T = T/W^{1/3} \quad \frac{\text{sec}}{\text{KT}^{1/3}}$$

Then to find the radius for 1 MT, scale as follows:

$$R_W(KT) = R_{1KT}(W)^{1/3}$$

# SECTION IV

# SURFACE BURST

## GENERAL

This study began with an attempt to determine if a high pressure precursor would develop from a surface burst. A surface burst was defined as a nuclear detonation at zero HOB. The ground surface is represented as a perfectly reflecting surface, although the air layer near the ground is modified as if there were an interacting ground. From the calculation of the surface burst, there is a clear indication of a significant precursor at the 600-psi level.

Previous calculations of precursed environments for 1-MT cases indicated no precursor formation above 300 psi (ref. 3). However, those cases considered were for 1500 and 2000 ft HOB. In addition, the thermal layer model used was different.

## IDEAL CASE

Since zoning affects obtainable peak pressure values, an ideal case was computed as a comparison. Ideal surface calculations were completed for each of the calculations reported here. The ideal surface burst case results are presented in appendix A. Listed are times, ground range associated with the peak overpressure, ground range associated with the peak dynamic pressure, and the peak dynamic pressure.

## NON IDEAL CASE

The precursed surface burst case began to show differences at approximately 1000 psi. In figure 16 one can see the initial toeing out due to the heated layer ahead of the shock front. In figures 17 and 18, peak overpressure waveforms for the ideal and precursed cases are compared. On the front side of the precursed waveform a modification can be seen. The rise time to the peak is lengthened considerably while the peak value is decreased approximately 20 percent. Figures 19 and 20 show that for the precursor the peak dynamic pressure was increased only about 10 percent. The small discontinuities on the waveforms correspond to rezones.

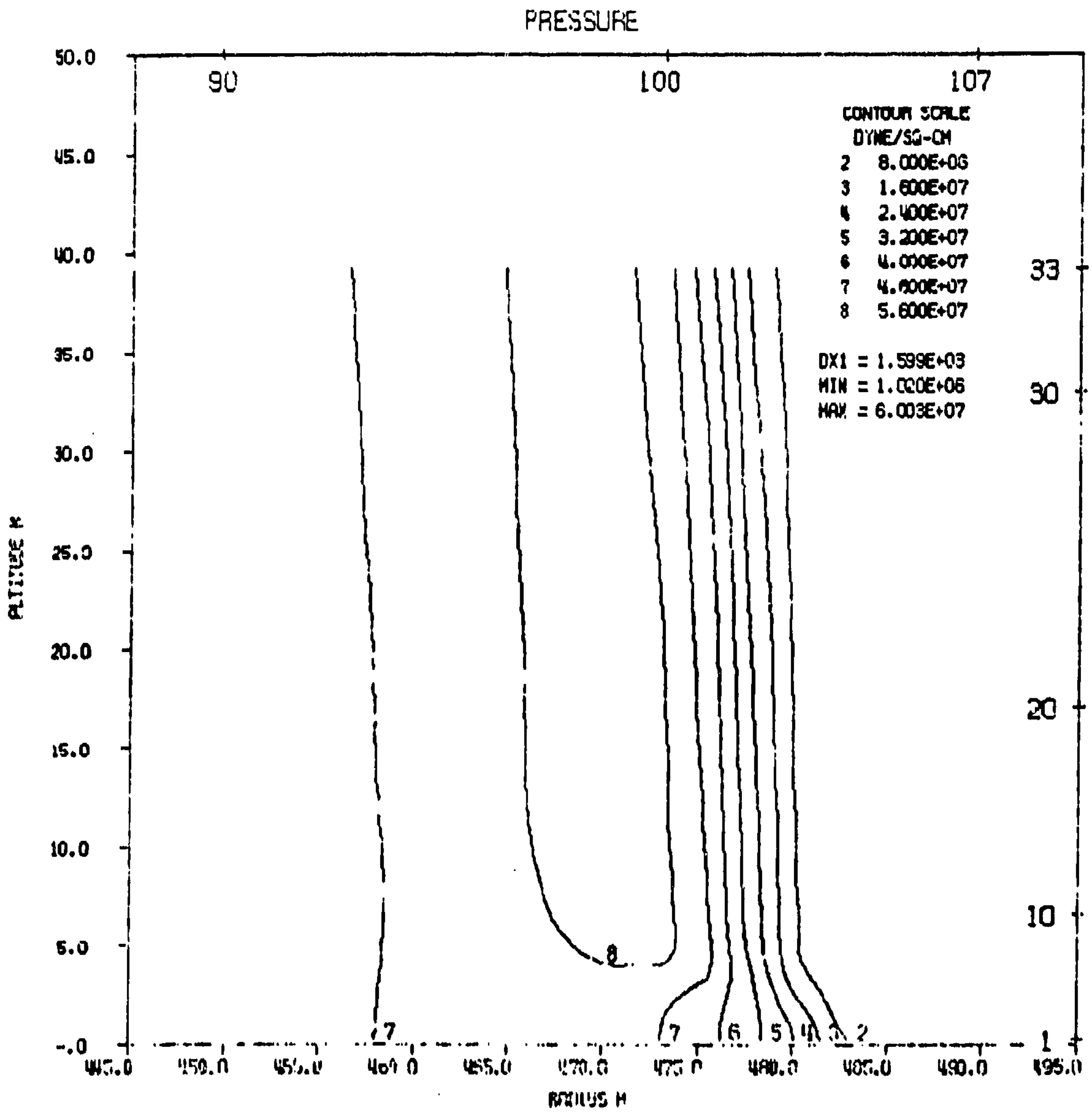


**Figure 16. Pressure Contours Showing the Initial Toeing Ahead of the Shock Front**

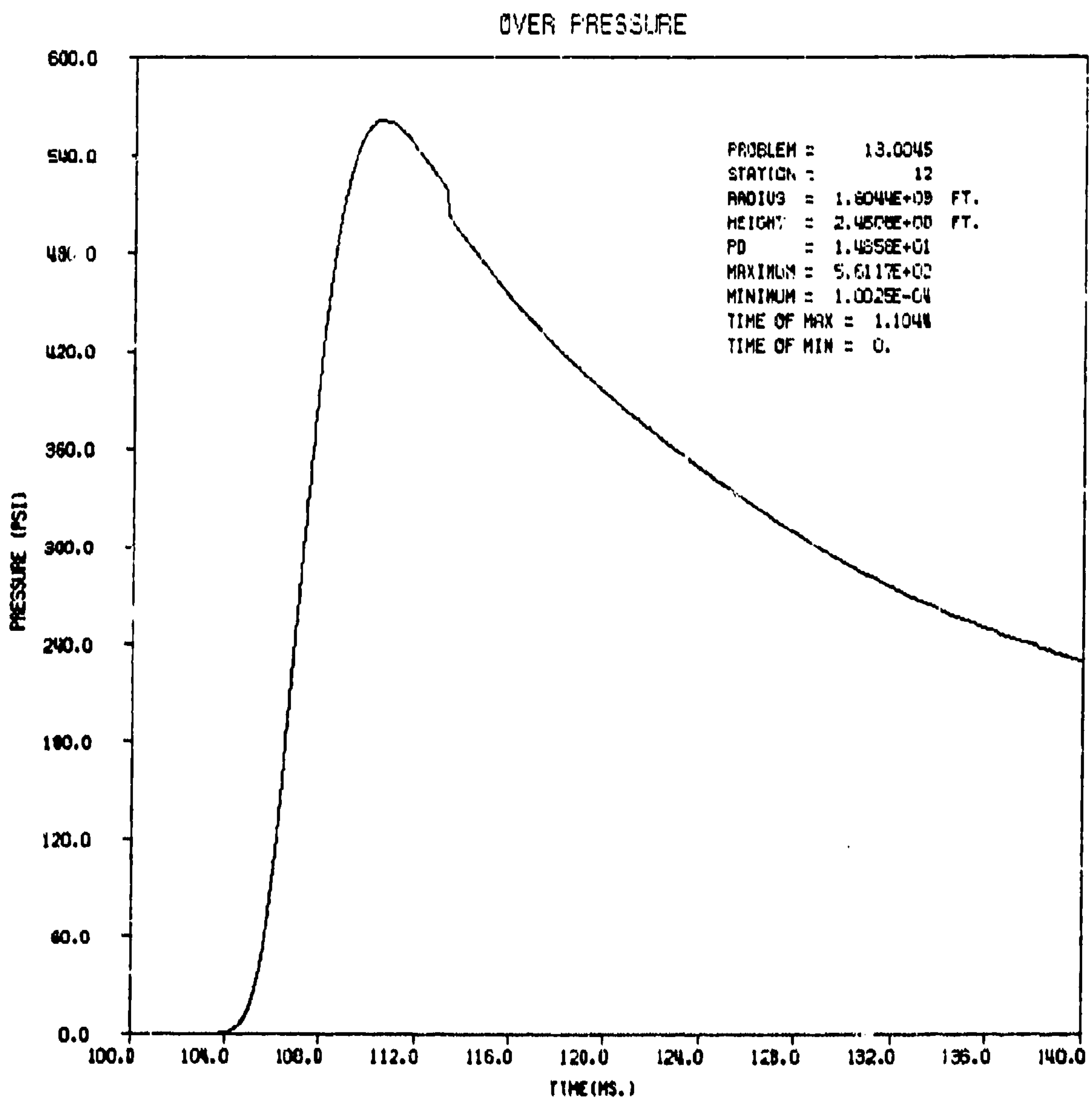


Figure 17. Overpressure versus Time Ideal Case 1 MT Surface Burst

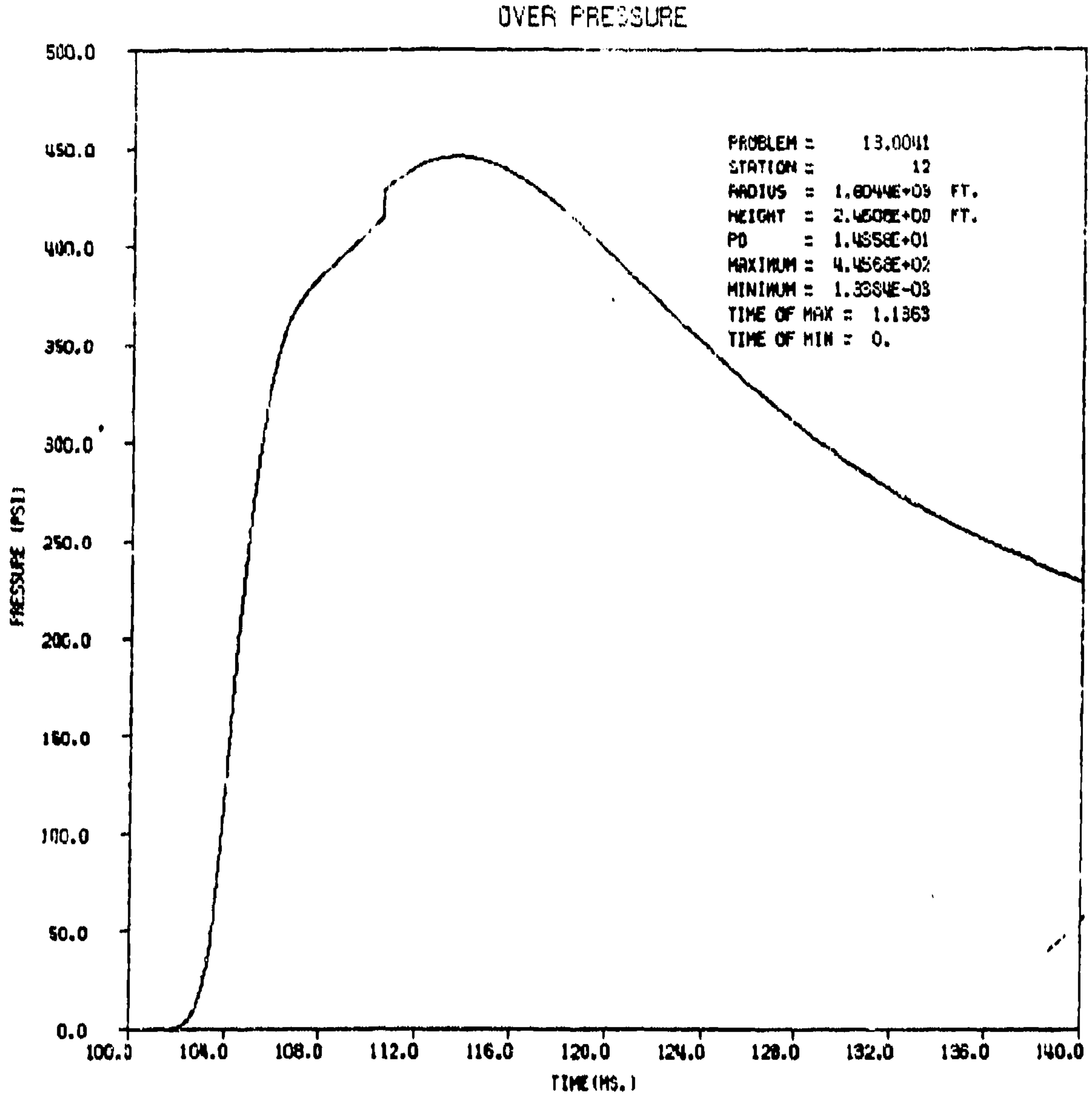


Figure 18. Overpressure versus Time, Precursed Case 1 MT Surface Burst

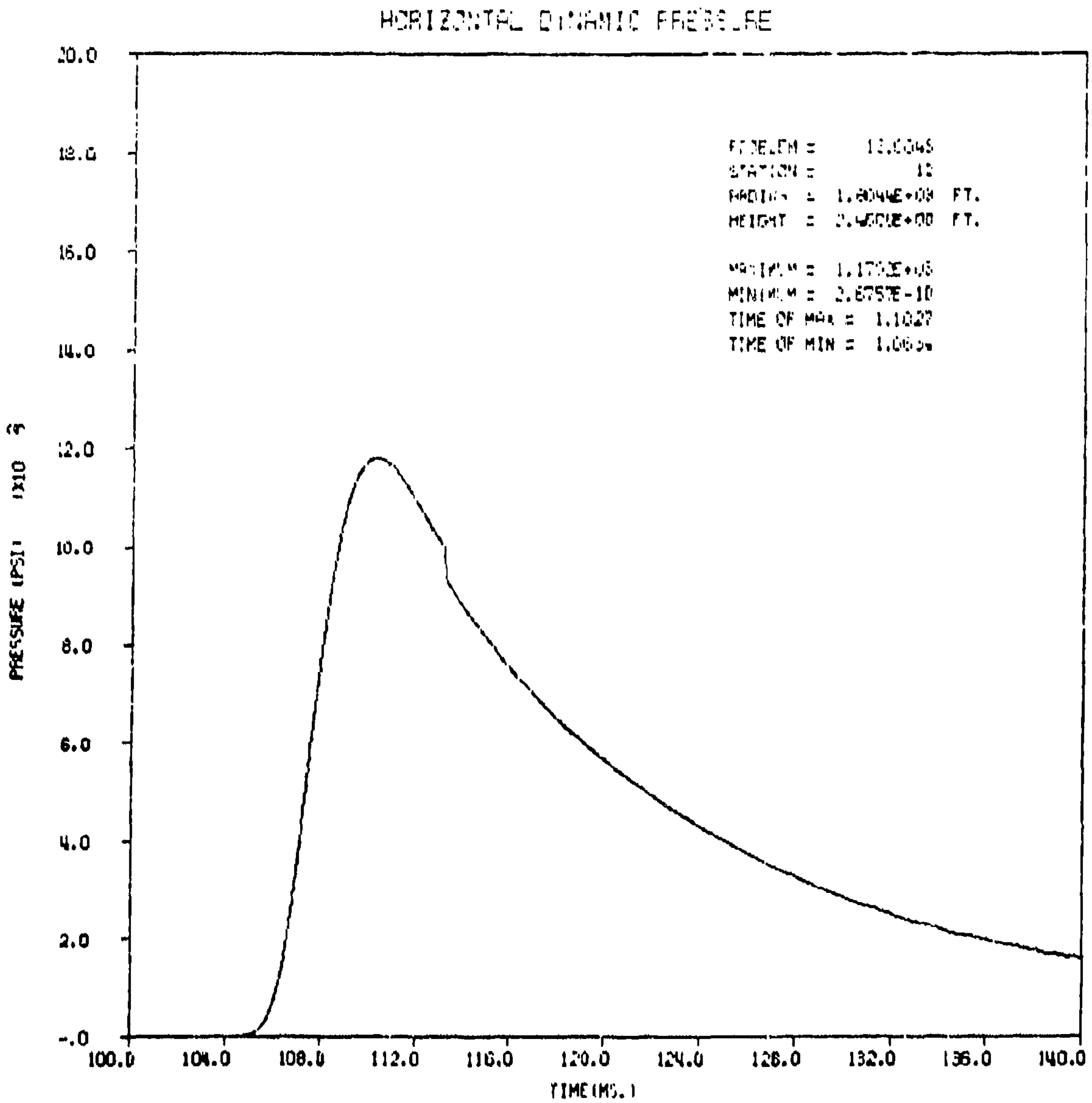

Figure 19. Horizontal Dynamic Pressure versus Time Ideal Case 1 MT Surface Burst

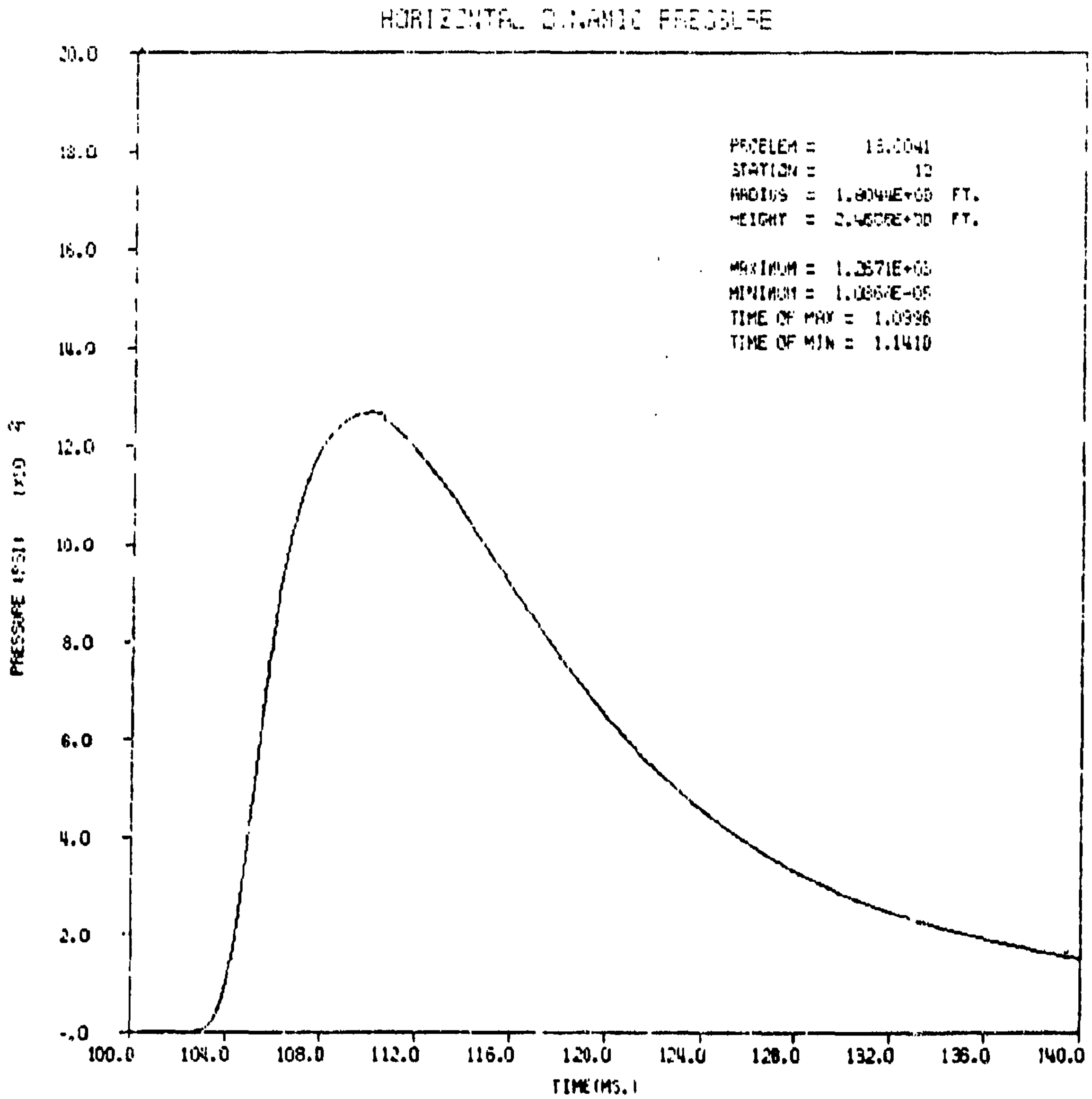


Figure 20. Horizontal Dynamic Pressure versus Time Precursed Case 1 MT Surface Burst

Appendix B contains the tabulated values of peak pressure and dynamic pressure versus ground range. In figure 21 the peak overpressures versus range are plotted. Problem 13.0041 refers to the precursed case while 13.0045 and 13.0143 refer to the ideal case. For the range 450 to 750 meters the peaks are decreased considerably. The maximum difference occurs at approximately 600 meters. Figure 22 is a plot of dynamic pressure versus range. The maximum difference in dynamic pressure occurs at approximately 475 meters. Between 400 and 500 meters the heated layer acts on the shock front in the expected way. The overpressures are dropped as the shock front toes out, producing the "front porch" effect. Conversely, the dynamic pressures are increased. However, because of the low angle of incidence between the fireball and the ground, the fluence drops very rapidly as the ground range increases. Beyond 700 meters the overpressures are beginning to converge while the dynamic pressures have converged to the ideal case.

There is also an effect from the way in which the thermal layer model is implemented into the hydrodynamic mesh. The thermal layer model prescribes appropriate internal energy at any given time. We assume pressure equilibrium will be maintained. Therefore, we iterate upon the equation of state to reach this condition with the ambient atmosphere. In general, the assumption of pressure equilibrium decreases the density in the thermal layer, influencing the resulting dynamic pressures.

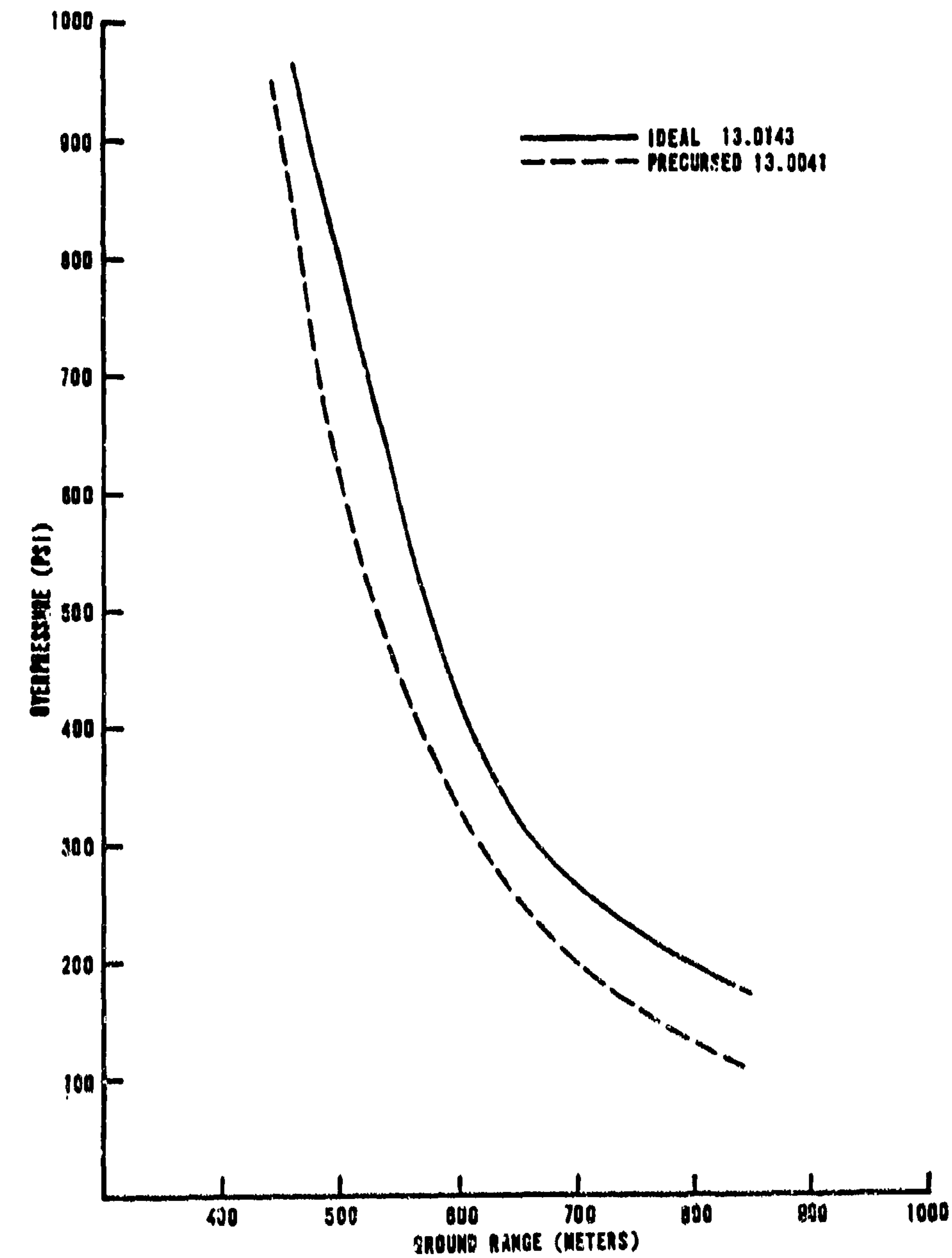


Figure 21. 1 MT Surface Burst Overpressures versus Range

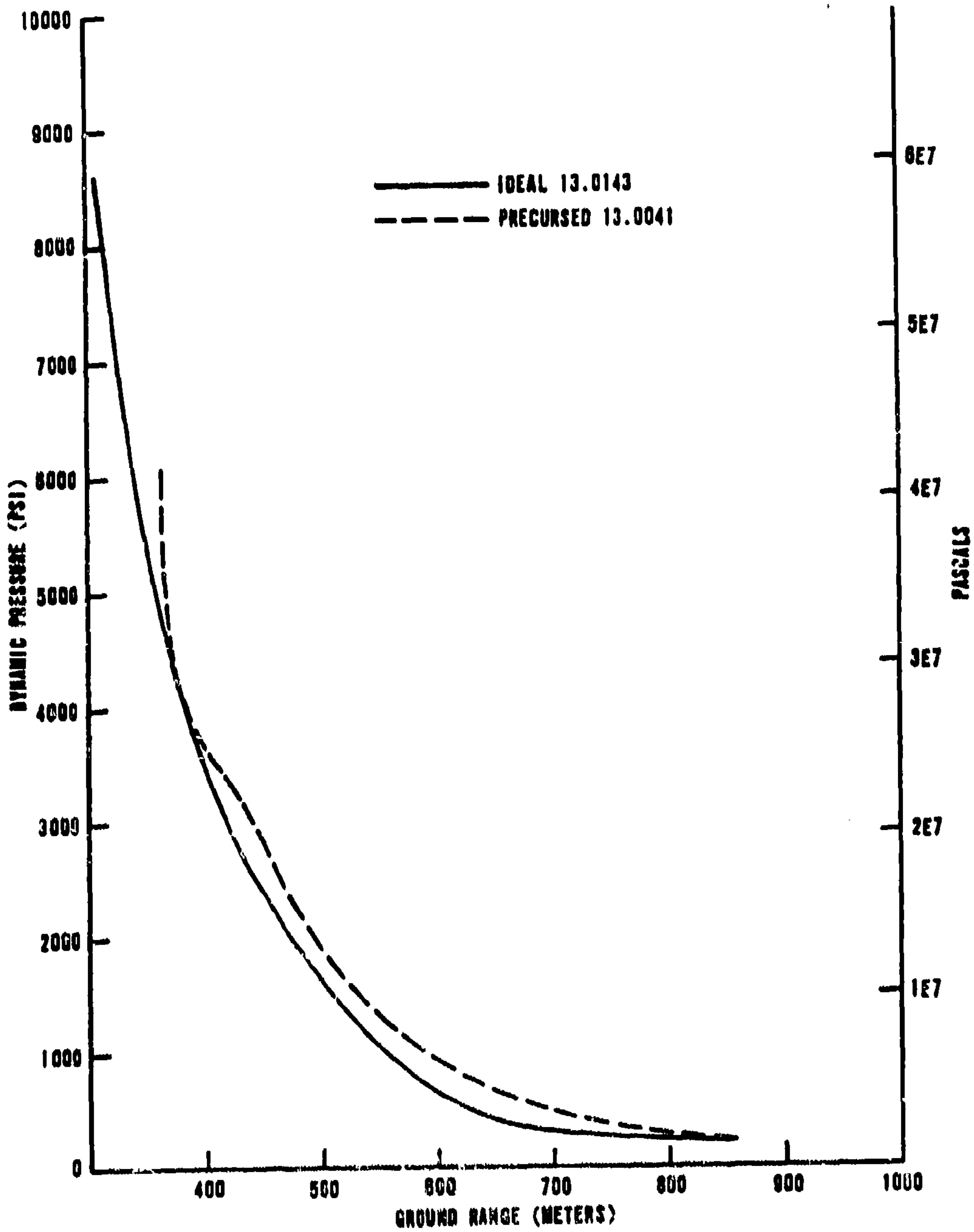


Figure 22. 1 MT Surface Burst Dynamic Pressure versus Range

# SECTION V

# HEIGHT OF BURST CASES

## GENERAL

All of the HOB cases show strong precursor effects. In general, the peak overpressures are reduced by as much as a factor of 2, while the dynamic pressures are increased as much as 50 percent. The effect of the precursor is definitely influenced by the HOB. As the HOB increases from 500 to 1000 feet, the precursor effect moves outward in ground range and influences the lower pressure levels. In addition, a significant modification of the blast wave front exists for the ideal case. This phenomenon is called the "hydrodynamic precursor." When the word precursor is used alone, it refers to that phenomenon created by the thermal layer.

At the point of maximum density, approximately 160 meters out along the ground, the flow is outward parallel to the ground. A few meters beyond that and just above the ground, the flow is directed downward. The existence of the very sharp gradient in both density and pressure, coupled with the flow pattern, leads to the toeing out of the shock front along the ground. These effects can be seen in figures 23, 24, and 26. Further out in time the triple point has migrated upward and outward. The specific energy contours (figure 25) indicate where the fireball is located. Figure 27 indicates the approximate position of the triple point in space for the 500-ft HOB case. The formation of the triple point starts at 15 msec. Immediately thereafter, one begins to see the appearance of double peaks along the ground. In figure 28 can be seen the behavior of the double peaks with time.

A precursor peak appears on the leading edge beyond 20 msec. By that time the triple point is approximately 5 meters in altitude. The precursor becomes equal to the main wave at 40 msec.

## HYDRODYNAMIC PRECURSOR

As the HOB of the nuclear detonation approaches the ground surface, the incident pressure on the ground increases and consequently the reflected pressure increases. Because of these extremely high pressures ($10^4$ psi) and the resultant compression of the air medium at the ground surface, densities are reached which

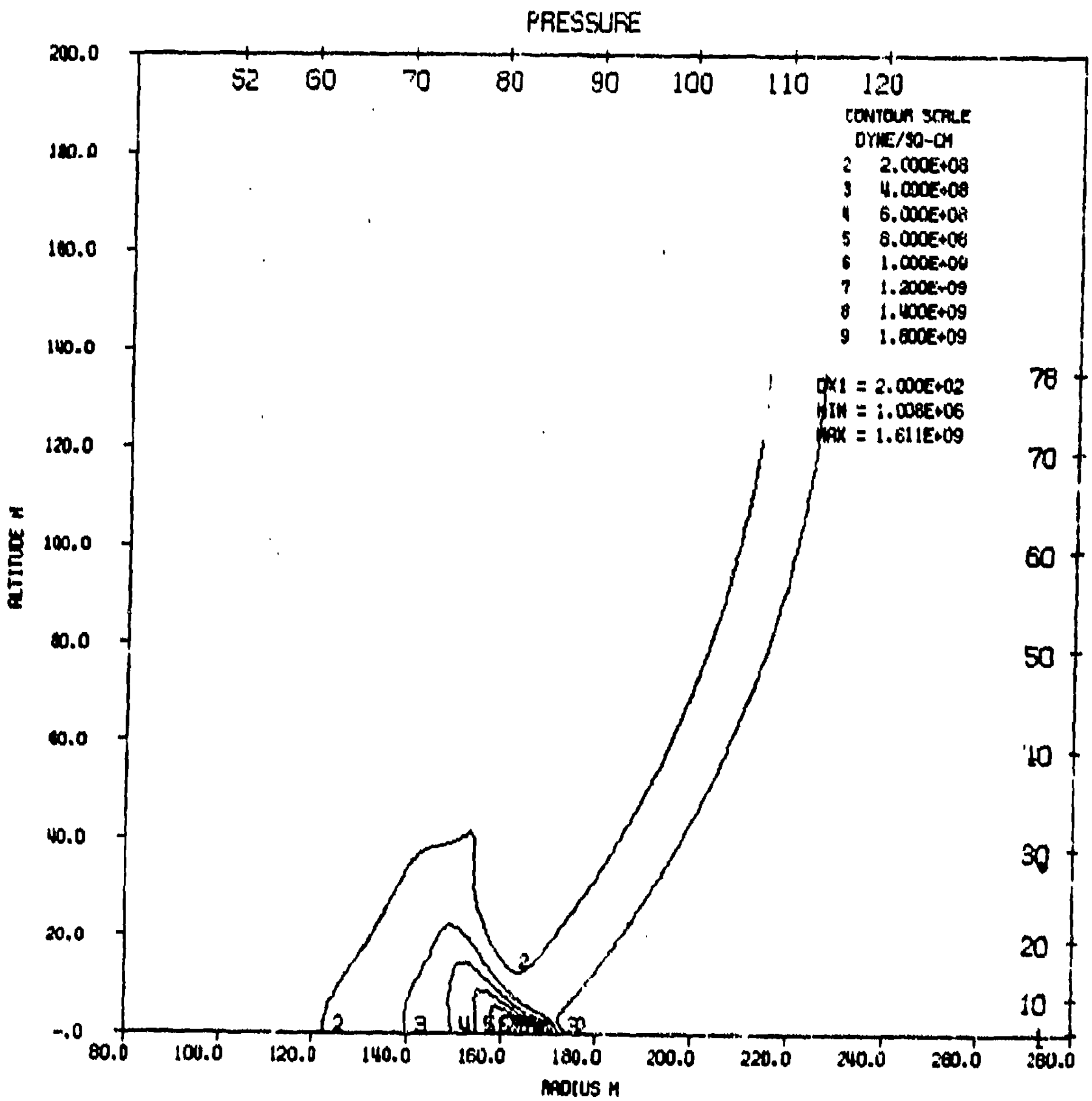


Figure 23. Pressure Contours for 1 MT at 500 Feet HOB, Ideal Case at 15 msec

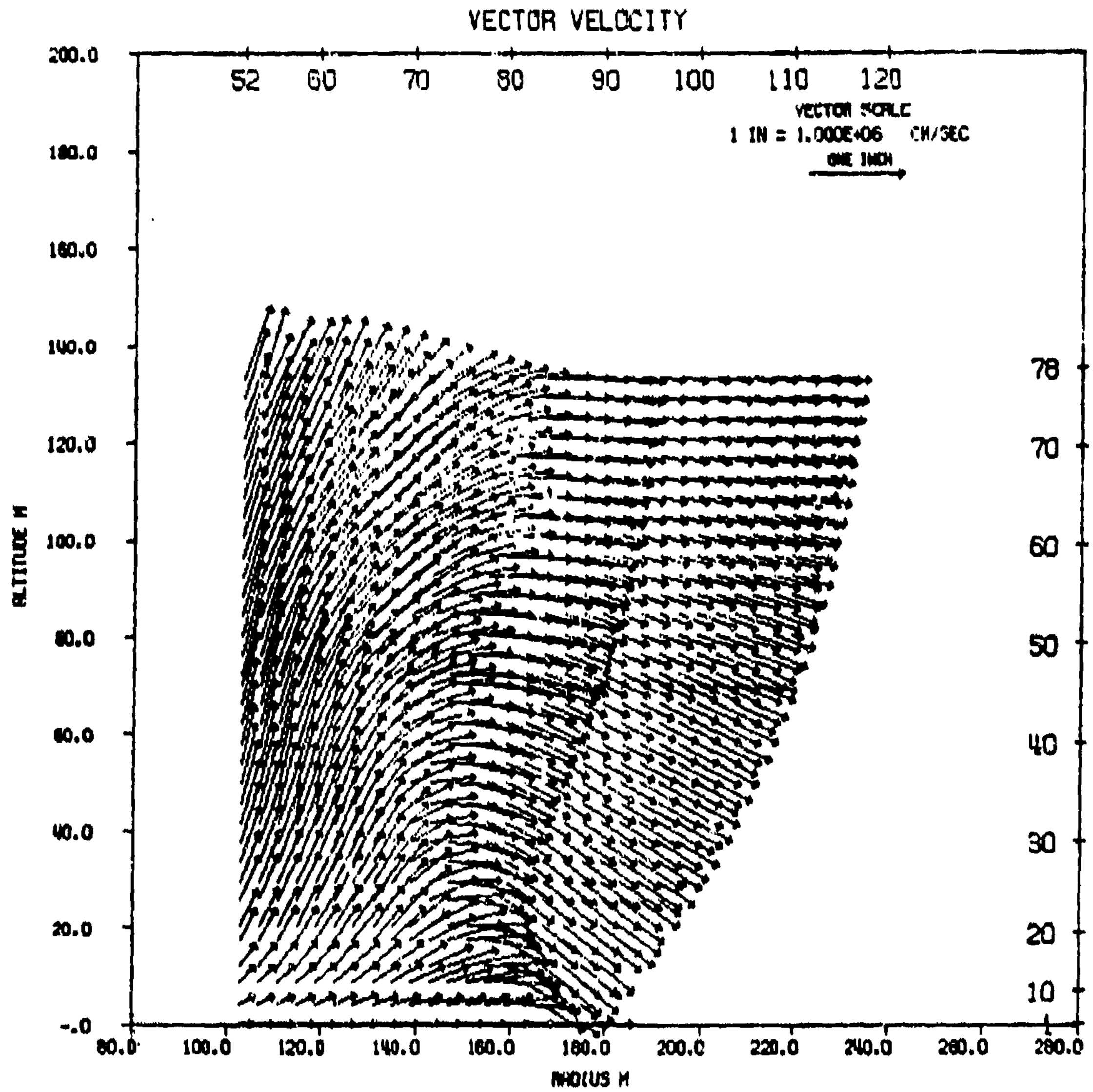


Figure 24. Velocity Vectors for 1 MT at 500 Feet HOB, Ideal Case at 15 msec

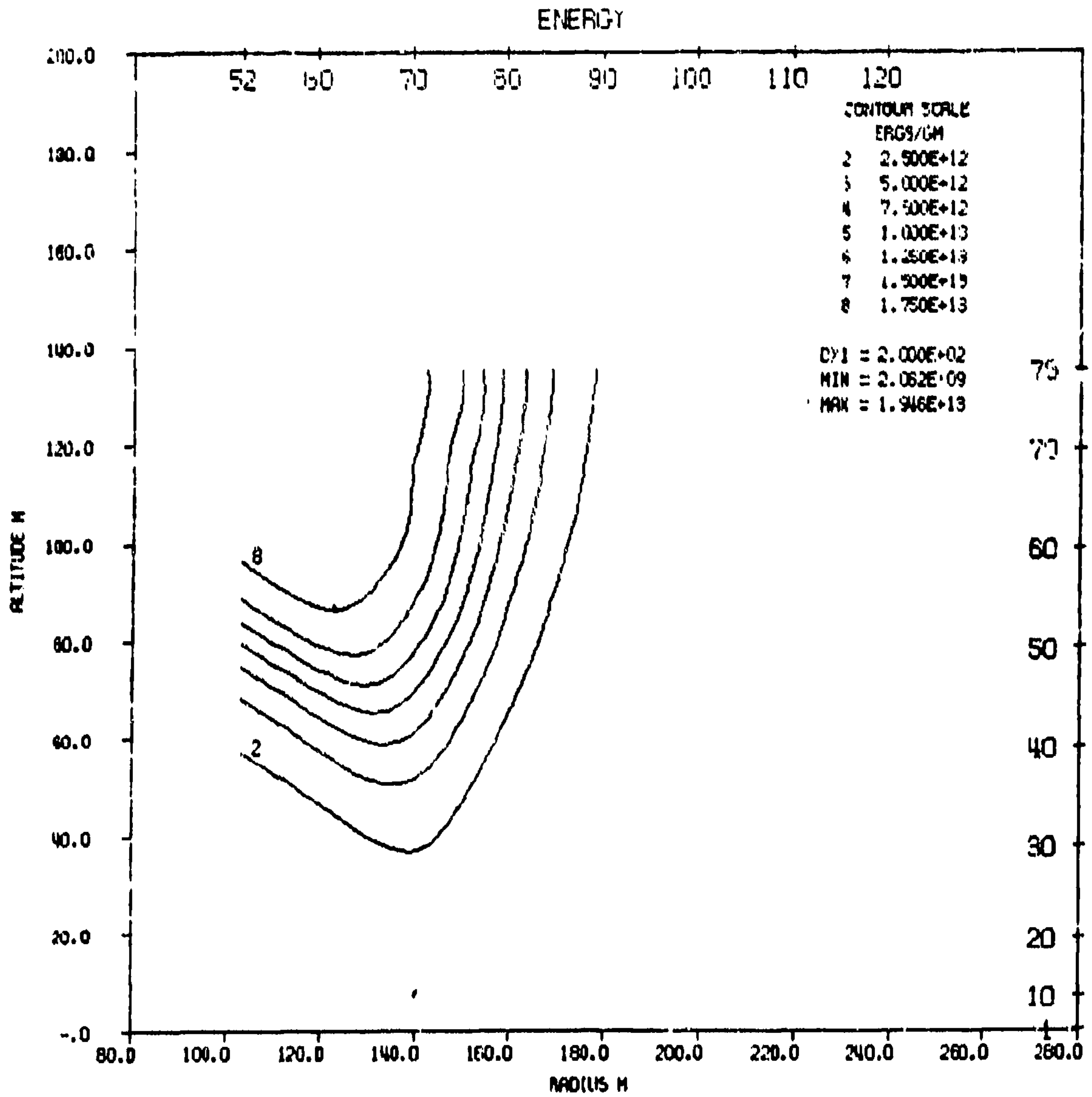


Figure 25. Energy Contours for 1 MT at 500 Feet HOB, Ideal Case at 15 msec

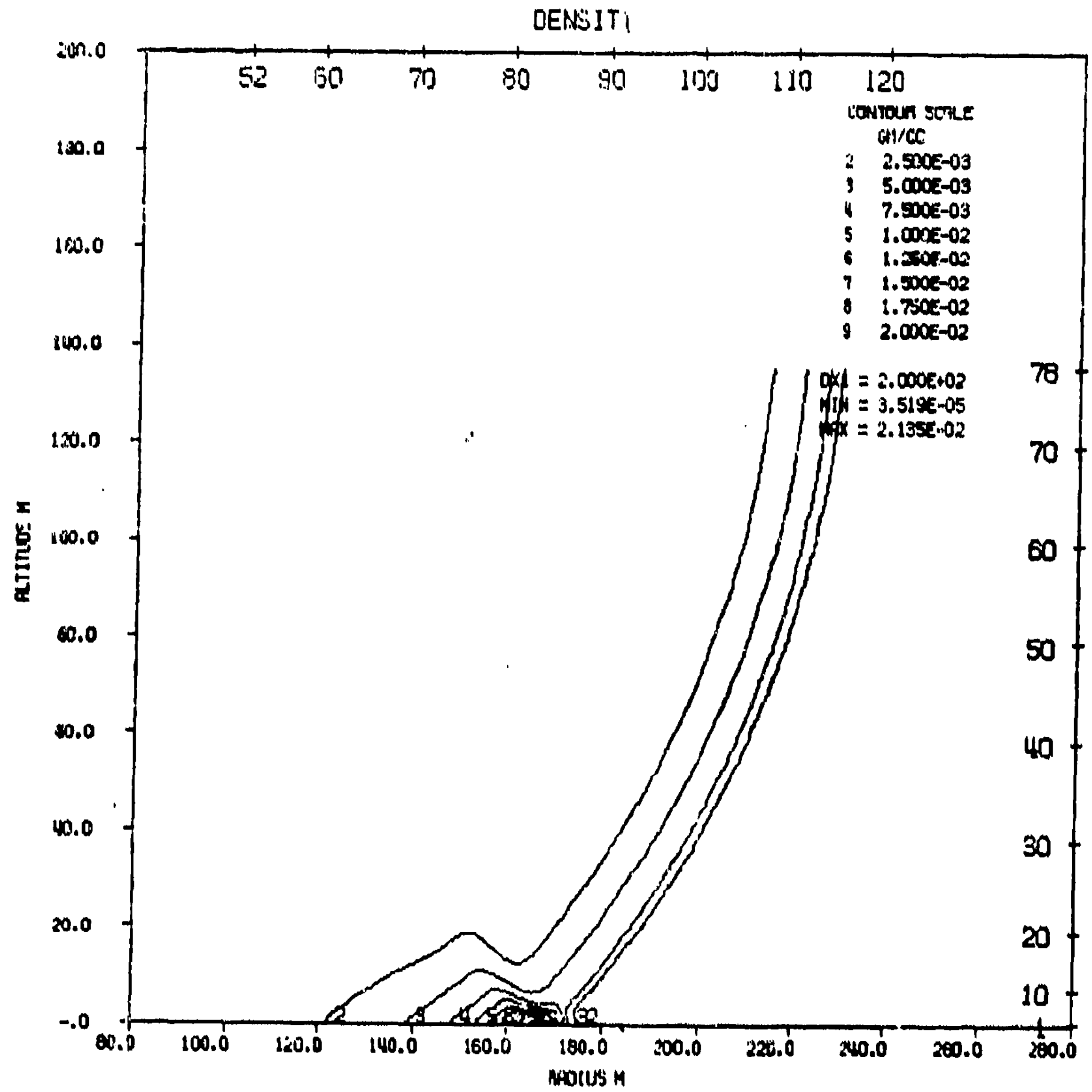


Figure 26. Density Contours for 1 MT at 500 Feet HOB, Ideal Case at 15 msec

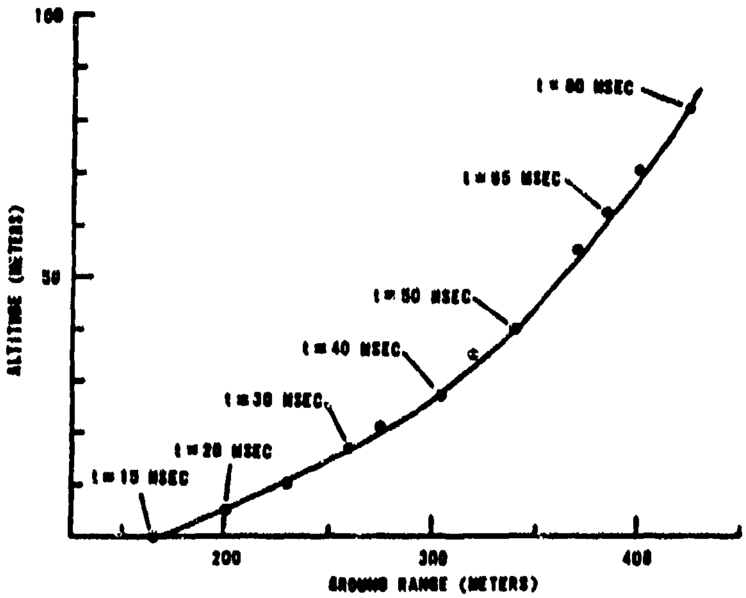


Figure 27. Triple Point Position for 1 MT at 500 Feet HOB, Ideal Case

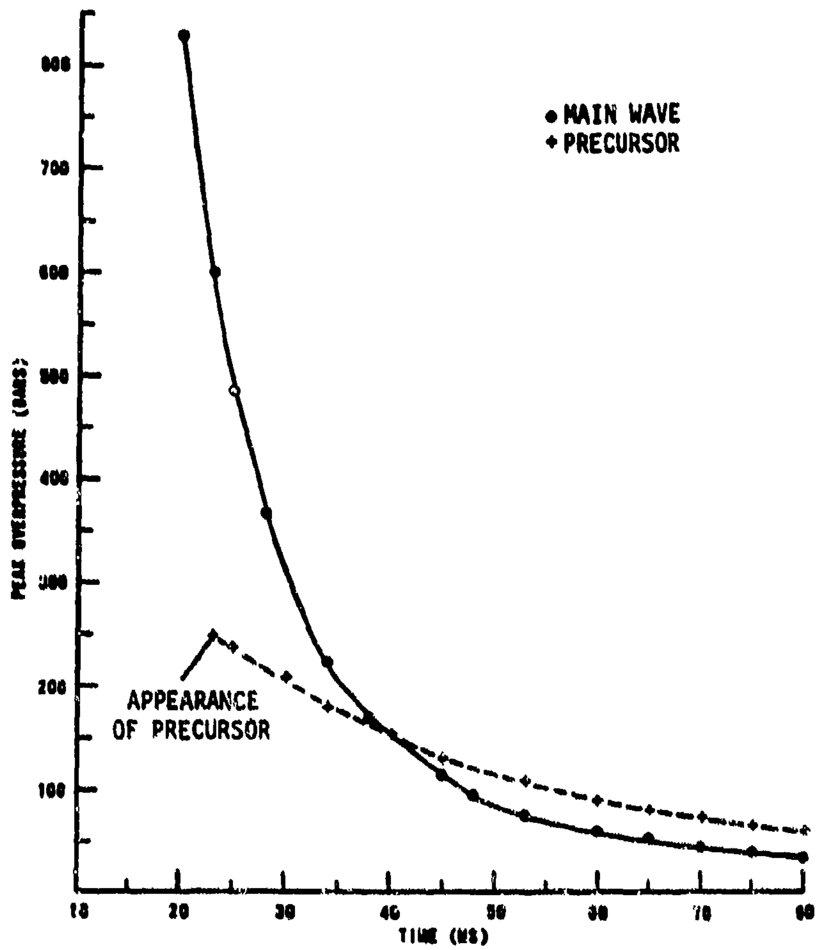


Figure 26. Peak Overpressure versus Time due to Precursor and Main Wave for 1 MT at 500 Feet HOB, Ideal Case

are approximately 20 times that of ambient air. The large densities and pressures develop a flow field which leads to the toeing out of the shock front.

This effect is shown in figures 29 through 32. To illustrate this point, the time of 30 msec was chosen. The contour plots show the two pressure peaks along the ground. The histogram plots, figures 33a through 33d, show the precursor is pronounced near the ground and decreases rapidly as one approaches the triple point, about 17 meters in altitude at a range of 260 meters. The overall appearance of the hydrodynamically precursed shock front at this point looks very much like a thermal layer precursor.

HEATED LAYER EFFECTS

When the heated layer produced by the thermal radiation is added to the calculation, the shock front is further modified. The result appears to be an enhancement of the toeing-out effect. In addition, peak pressures are reduced while the peak dynamic pressures are enhanced.

As the double peak in the shock front develops along the ground, the leading peak becomes the maximum. The effect of the thermal layer is to reduce this peak, thus reducing the maximum peak overpressure.

The most significant effect of the thermal layer along the ground combined with the varying HOB is the modification of the shock front at different ground ranges. At 500-ft HOB, modifications exist at several thousand psi. At 750-ft HOB, the modification begins at about 700 psi and continues beyond the times run for the calculation. At 1000-ft HOB, modification starts at about the 300-psi level and continues to times beyond calculation time. It is apparent that the precursor effect is very sensitive to HOB. For maximum modification at the ground range for which 600 psi occurs, the 750-ft HOB case is optimum. The following figures show a comparison of the ideal and precursed calculations for the three cases. Peak overpressures are presented in figures 34a through 34c, and peak dynamic pressures are presented in figures 35a through 35c.

The above result is reasonable from considerations of fluence upon the ground. As the HOB increases, the size of the angle between the slant range and the ground increases, increasing the amount of fluence for a given ground range. Also, the reflected shock strength decreases as the HOB is increased, leading to larger ground ranges before the Mach stem (in the ideal sense) can be formed. This conclusion is also consistent with the result of the previous 1-MT calculation (ref. 3).

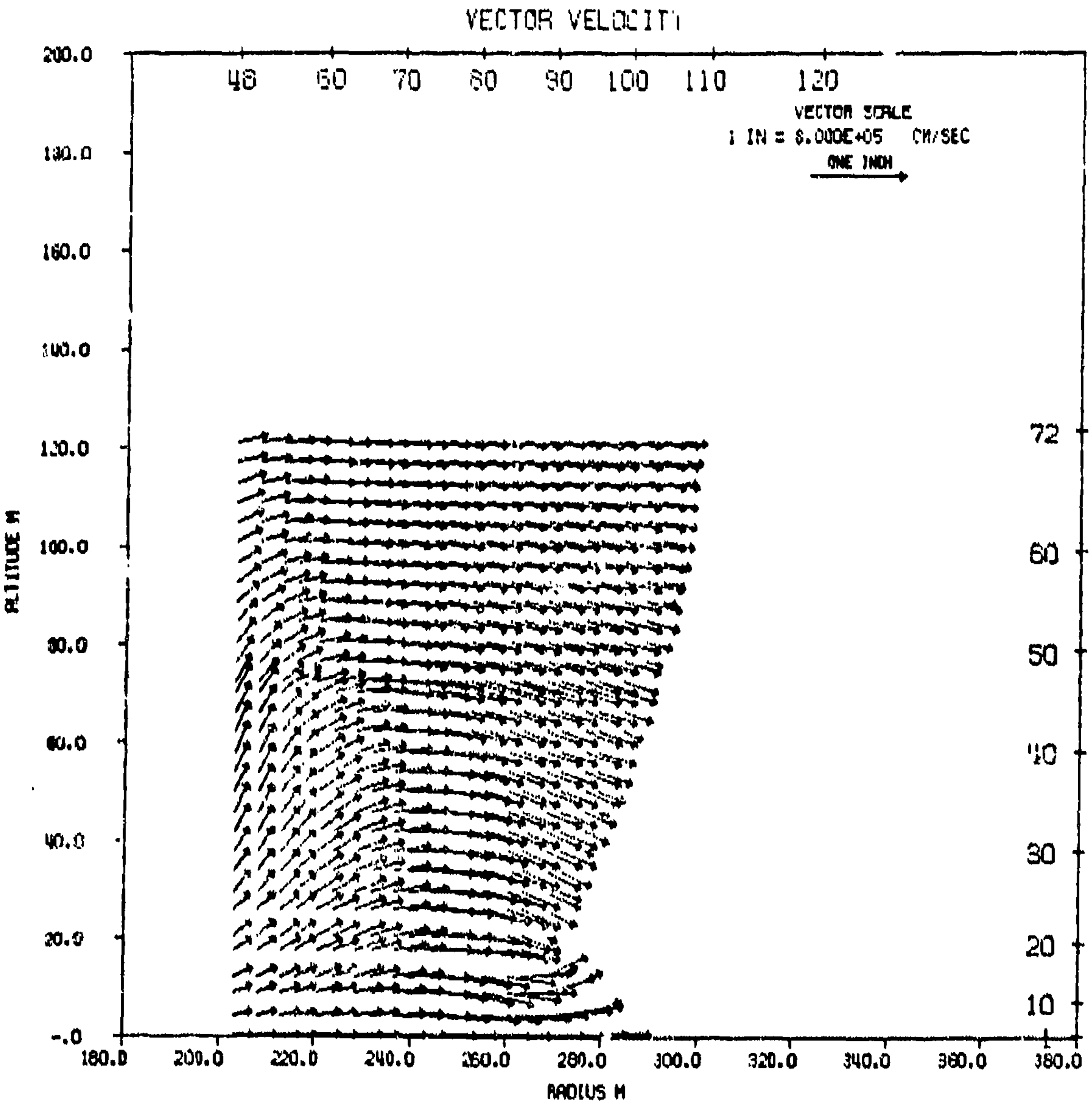


Figure 29. Velocity Vectors for 1 MT at 500 Feet HOB, Ideal Case at 30 msec

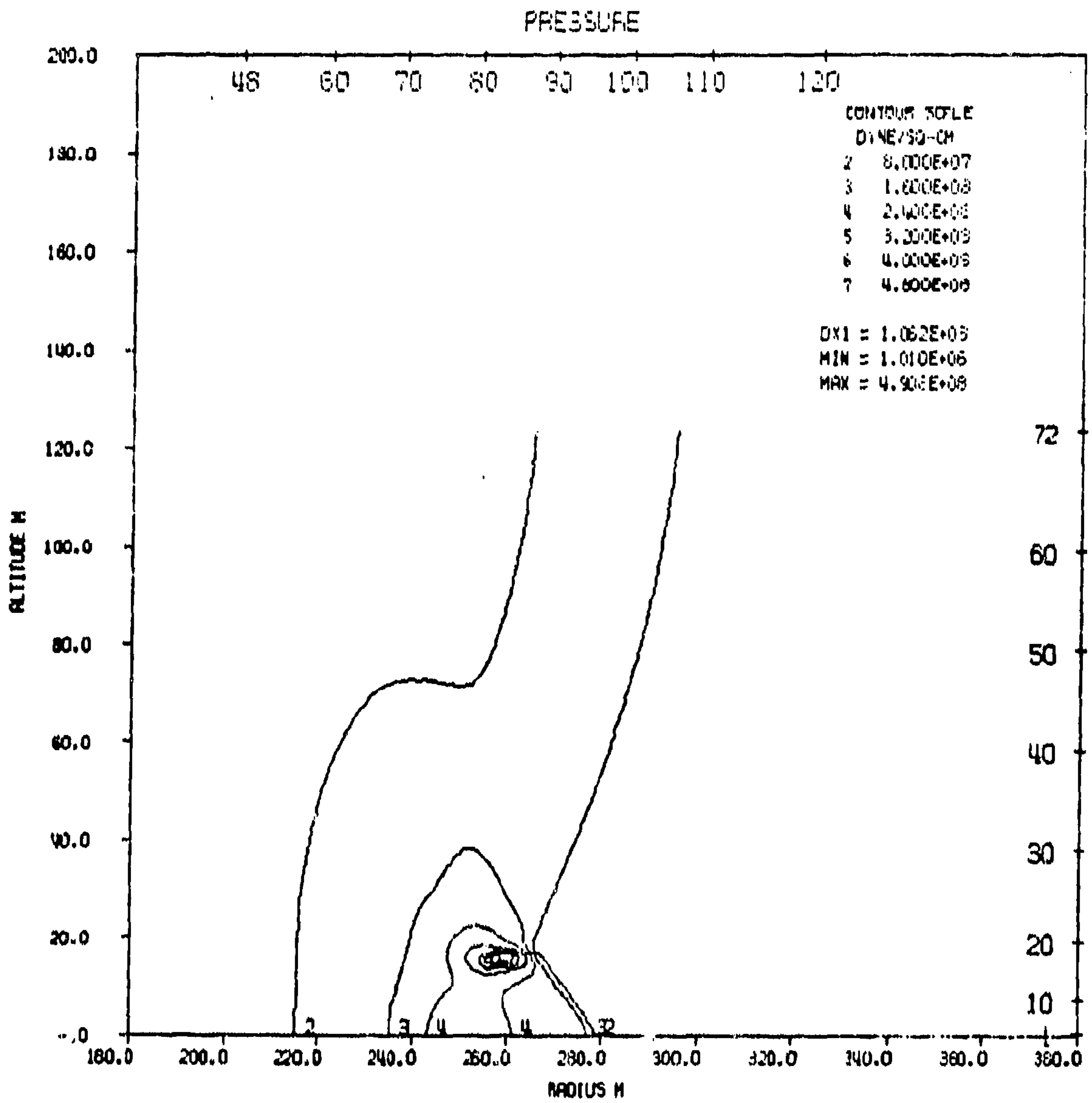


Figure 30. Pressure Contours for 1 MT at 500 Feet HOB, Ideal Case at 30 msec

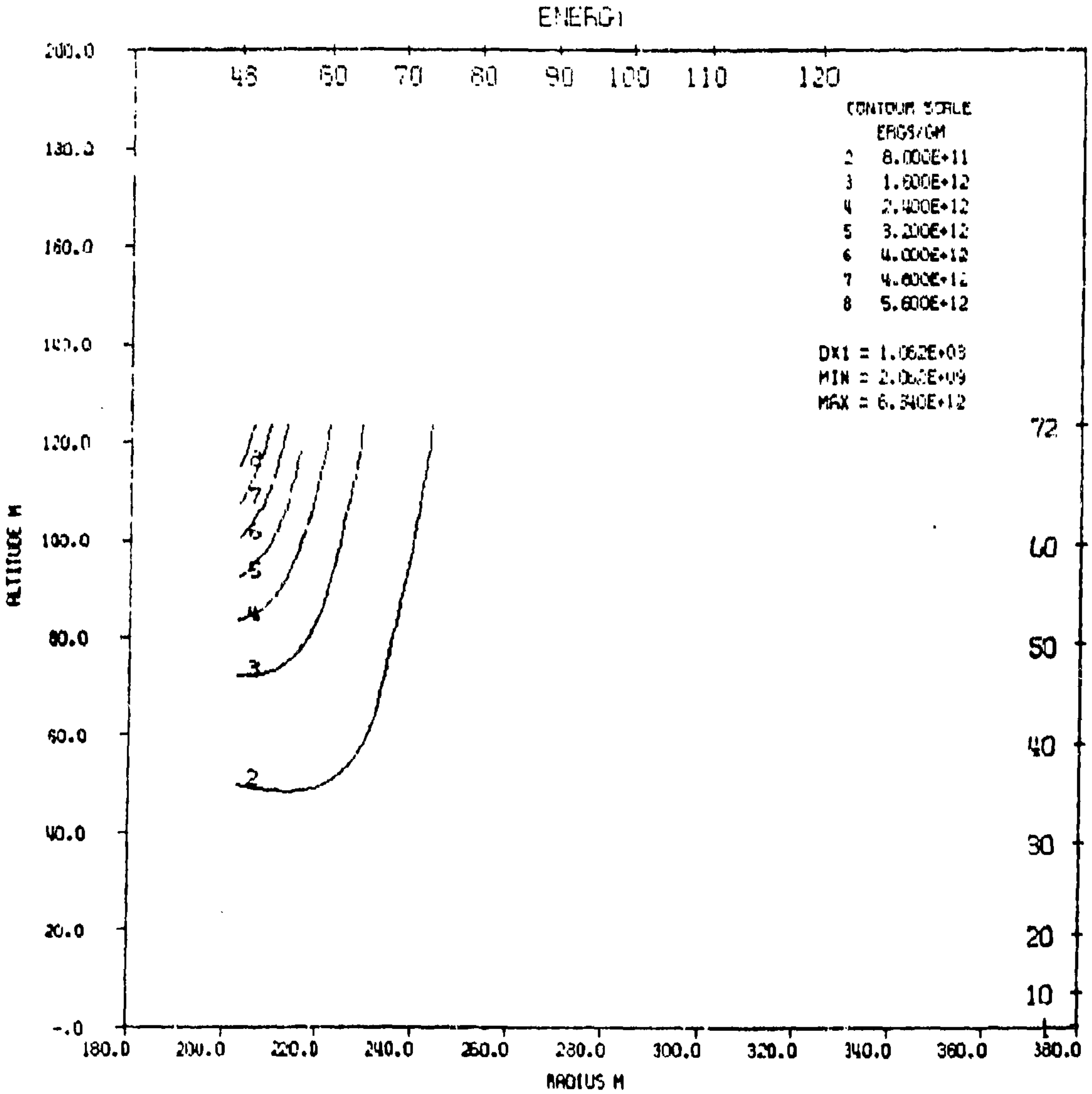


Figure 31. Energy Contours for 1 MT at 500 Feet HOB, Ideal Case at 30 msec

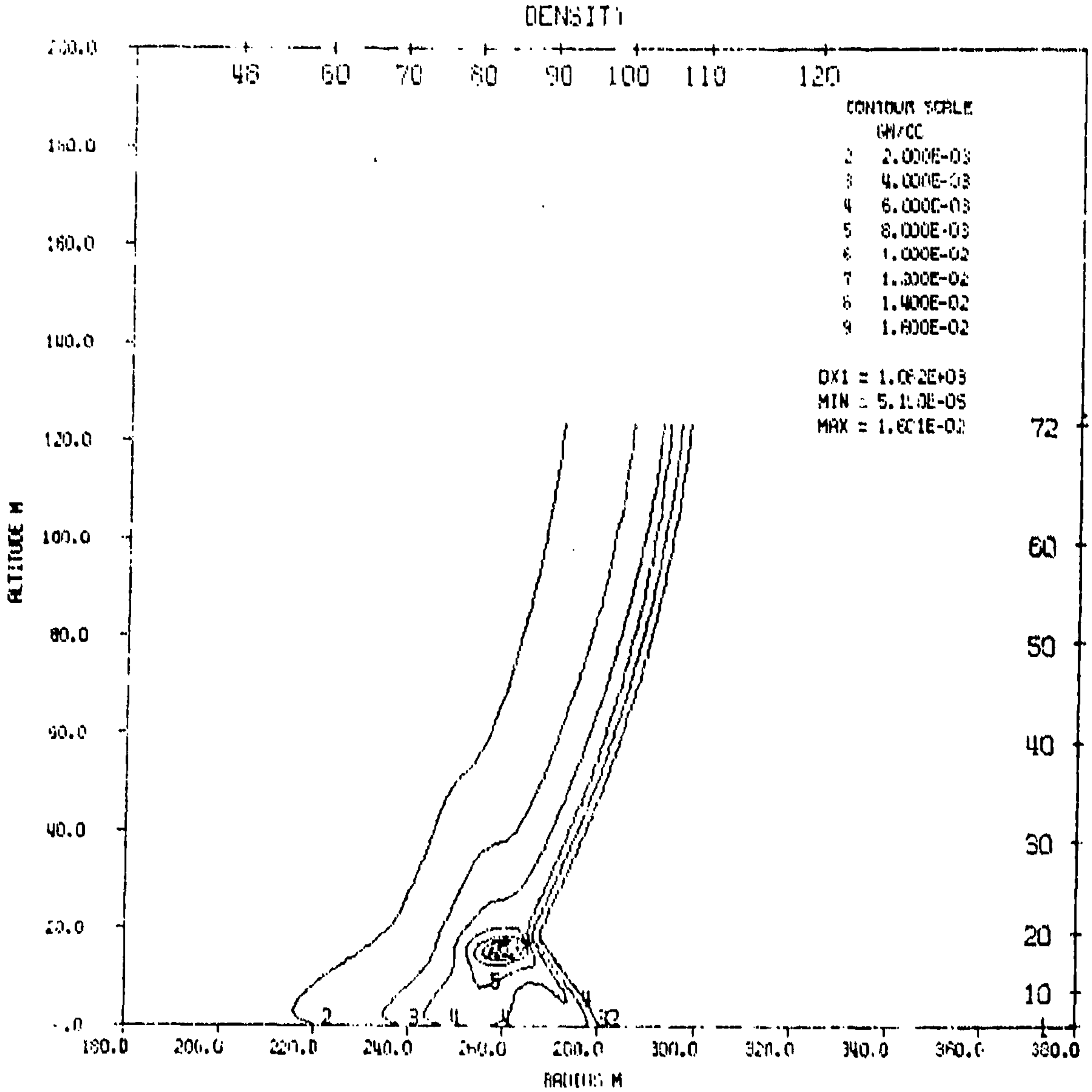


**Figure 32. Density Contours for 1 MT at 500 Feet HOB, Ideal Case at 30 msec**

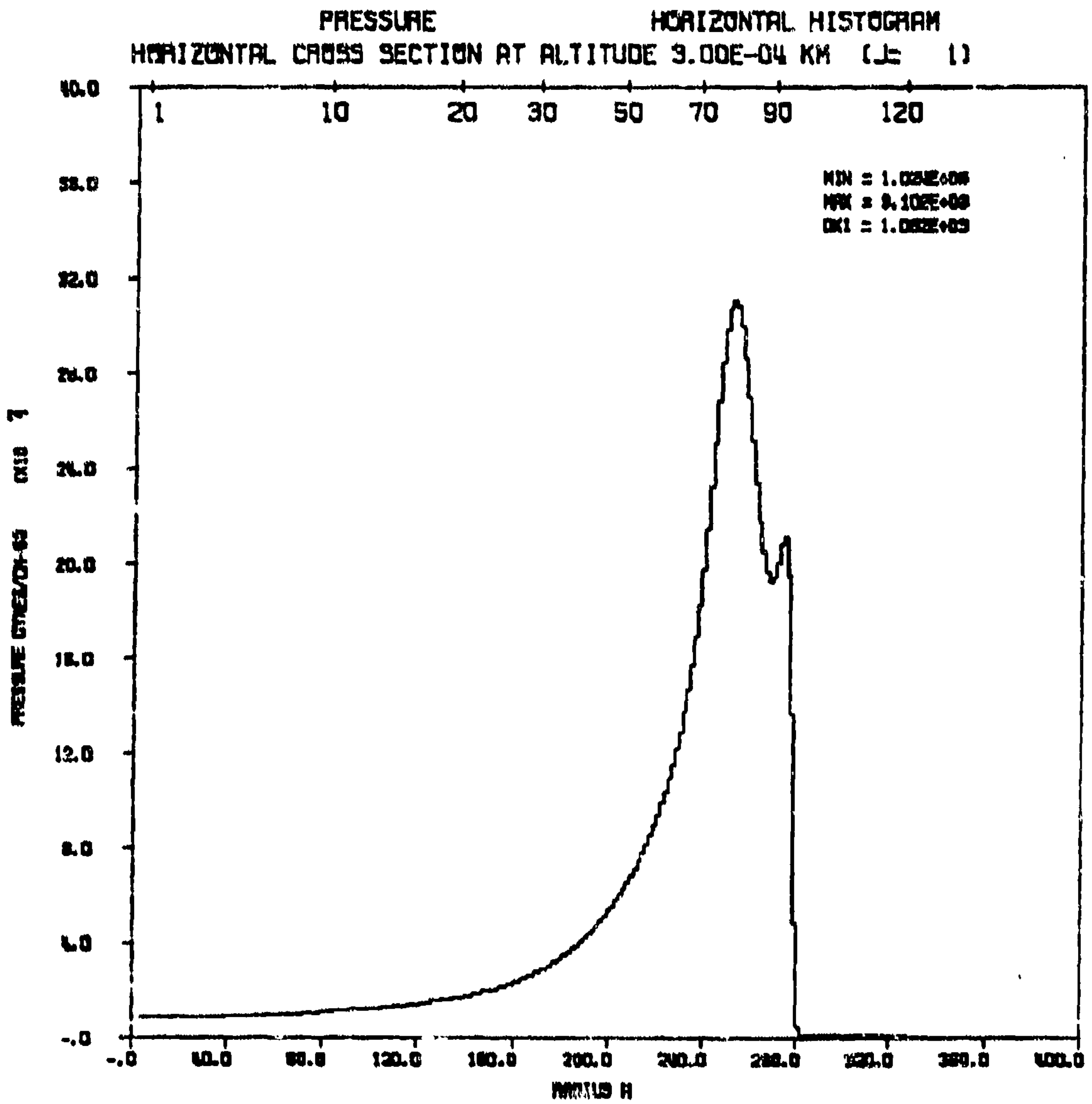


Figure 33a. Horizontal Pressure Histogram at 30 cm Altitude for 1 MT at 500 Feet HOB, Ideal Case at 30 msec

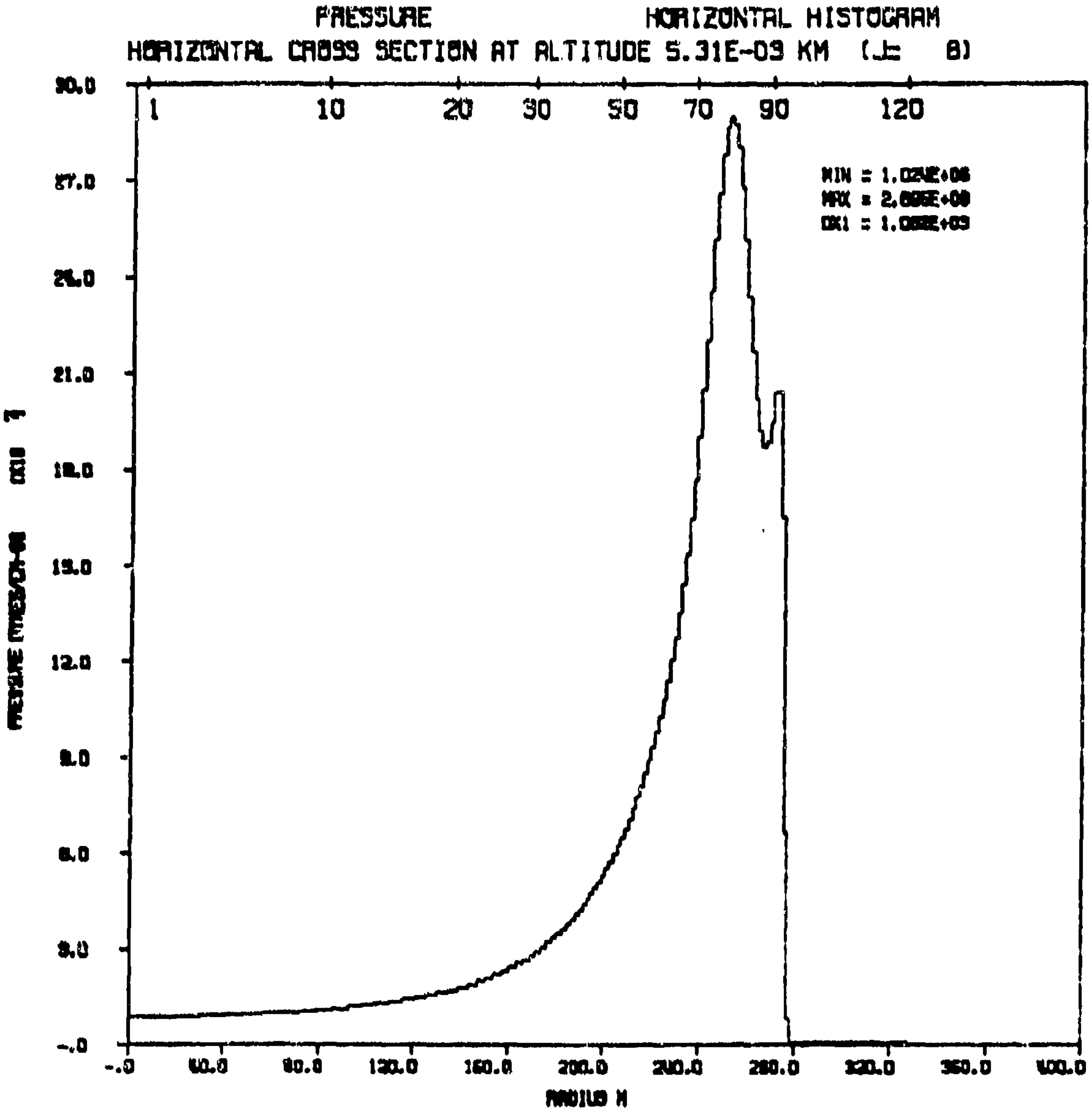


Figure 33b. Horizontal Pressure Histogram at 531 cm Altitude for 1 MT at 500 Feet HOB, Ideal Case at 30 msec

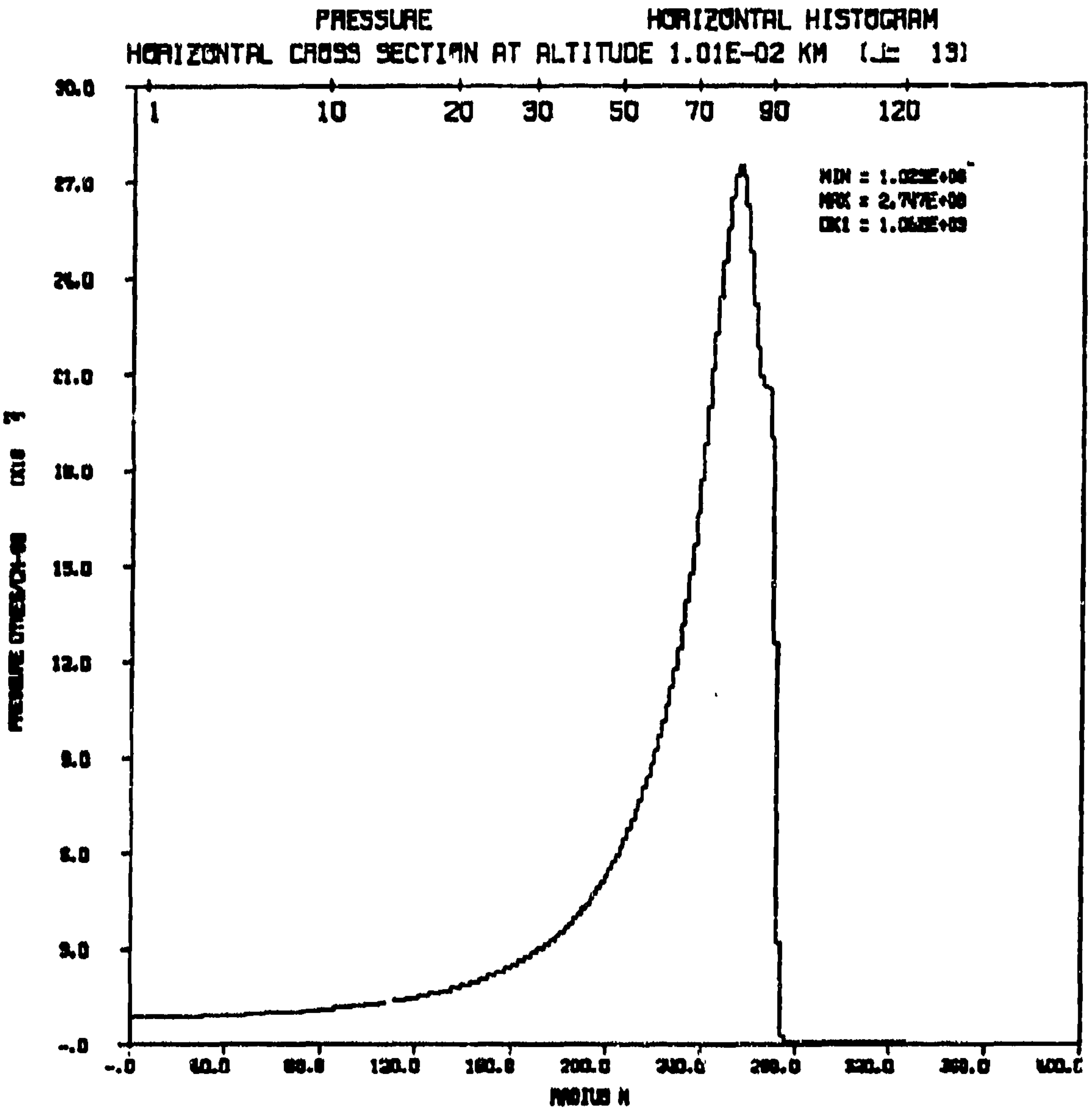


Figure 33c. Horizontal Pressure Histogram at 10.1 Meters Altitude for 1 MT at 500 Feet HOB, Ideal Case at 30 msec

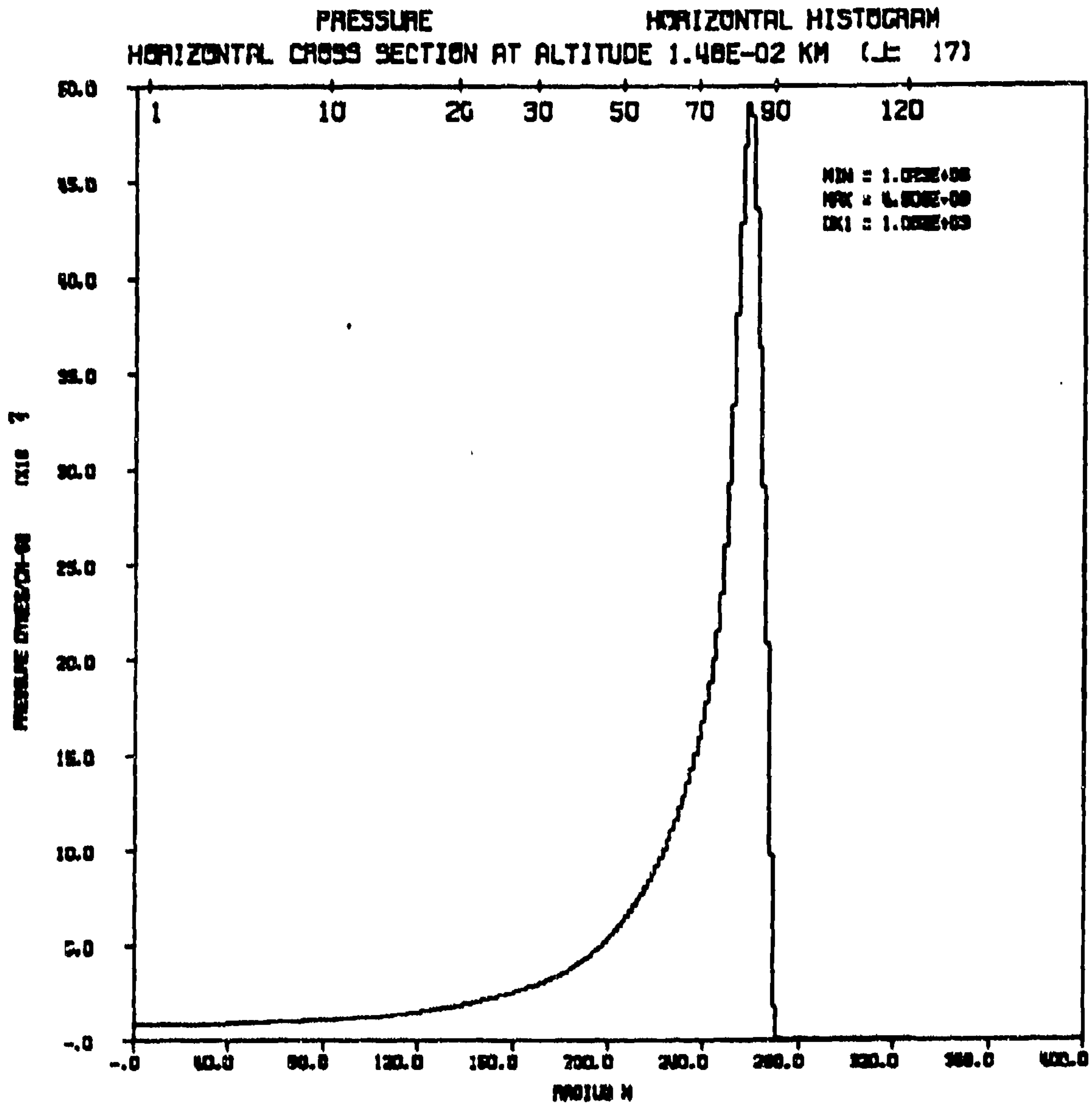


Figure 33d. Horizontal Pressure Histogram at 14.8 Meters Altitude for 1 MT at 500 Feet HOB, Ideal Case at 30 msec

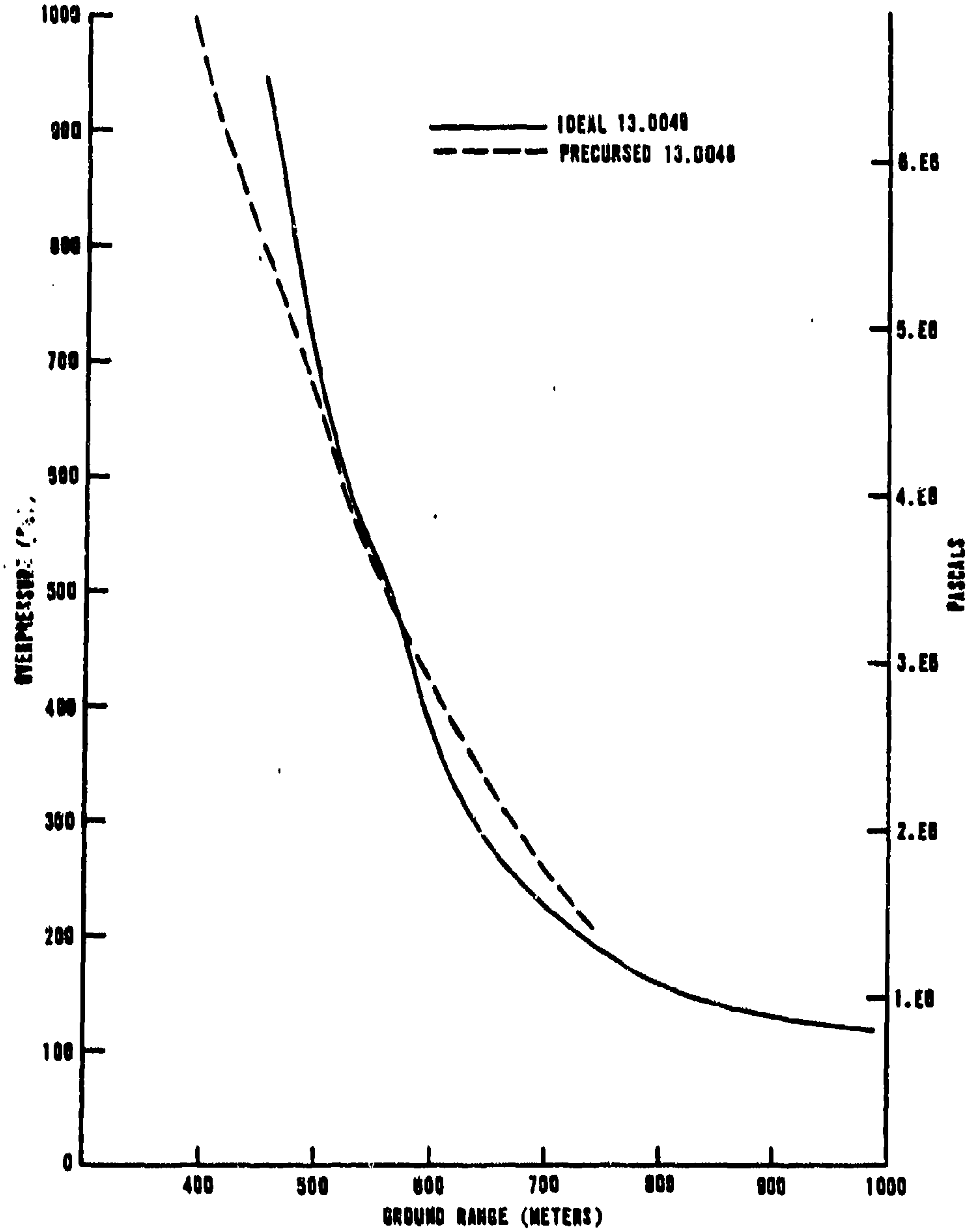


Figure 34a. Peak Overpressure versus Range for 500 Feet HOB Ideal and Precursed Cases

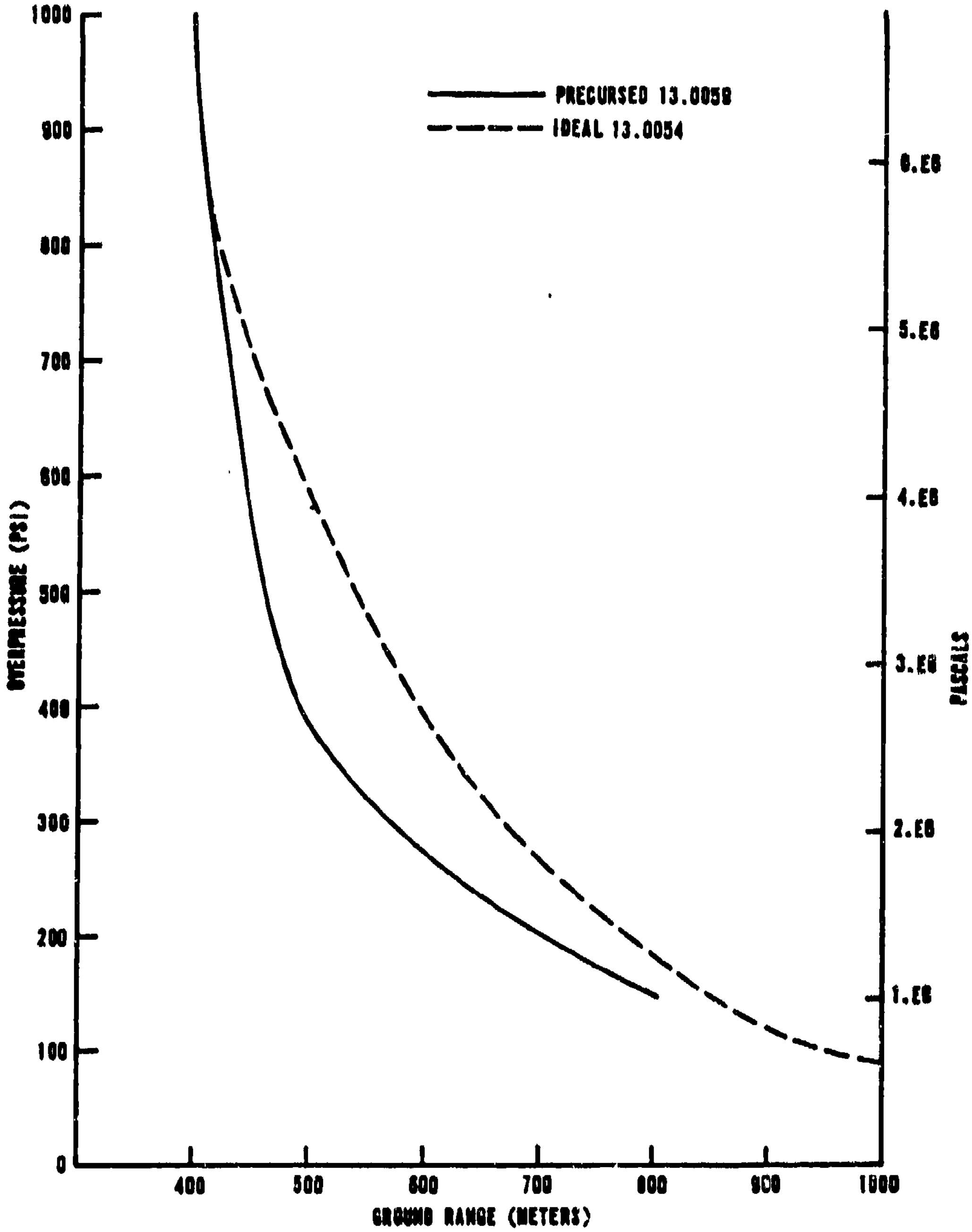


Figure 34b. Peak Overpressure versus Range for 750 Feet HOB Ideal and Precursed Cases

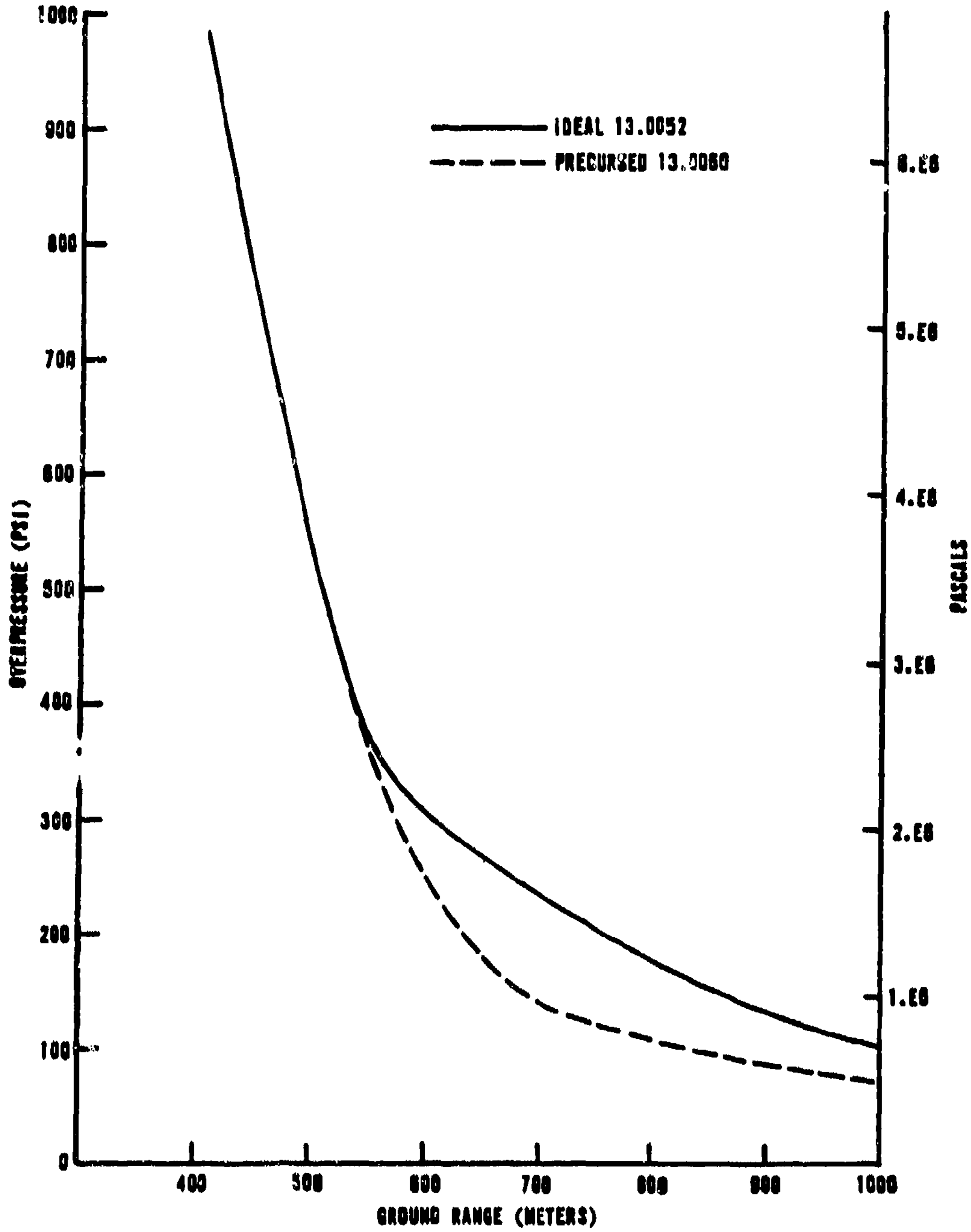


Figure 34c. Peak Overpressure versus Range for 1000 Feet HOB Ideal and Precursed Cases

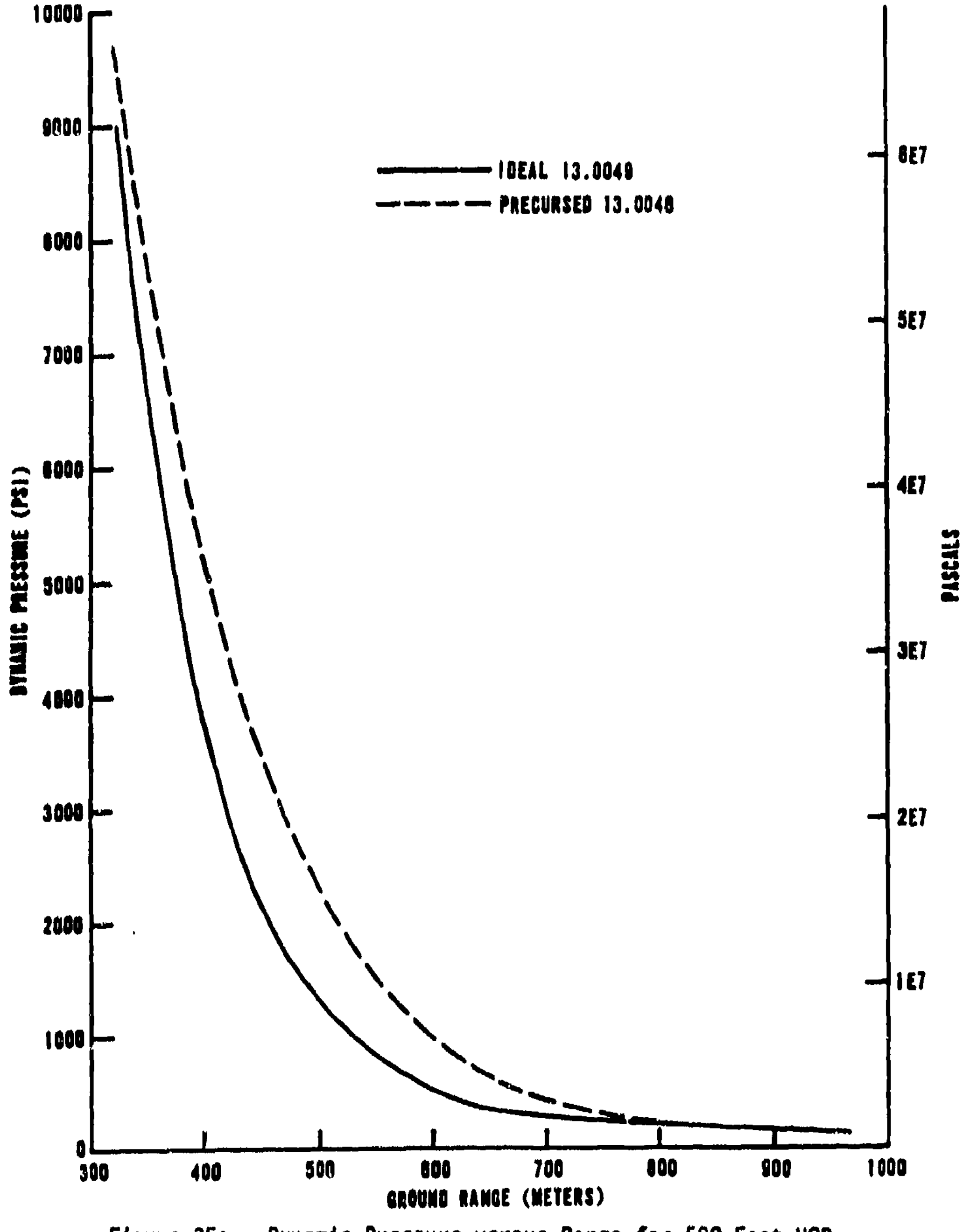


Figure 35a. Dynamic Pressure versus Range for 500 Feet HOB Ideal and Precursed Cases

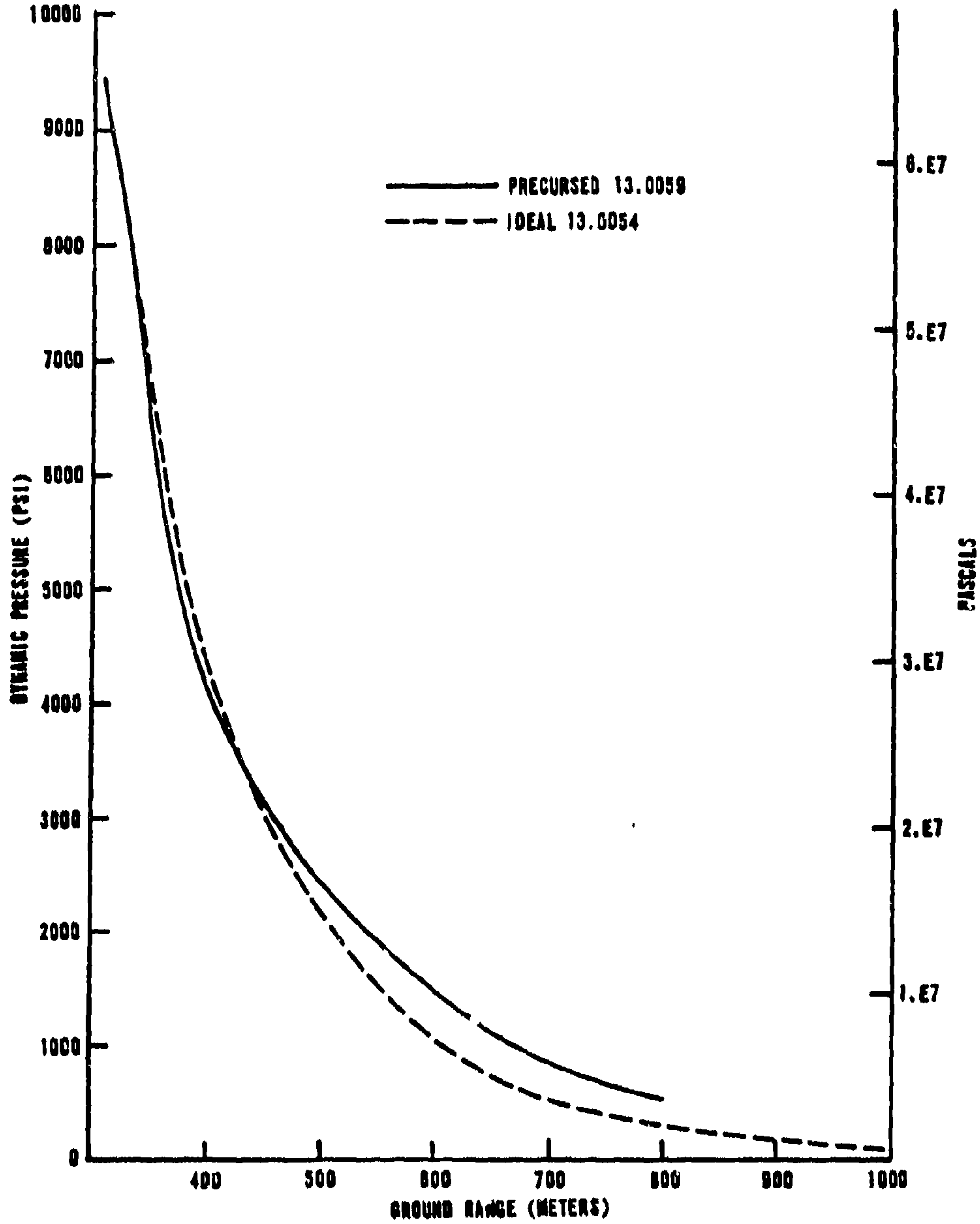


Figure 35b. Dynamic Pressure versus Range for 750 Feet HOB Ideal and Precursed Cases

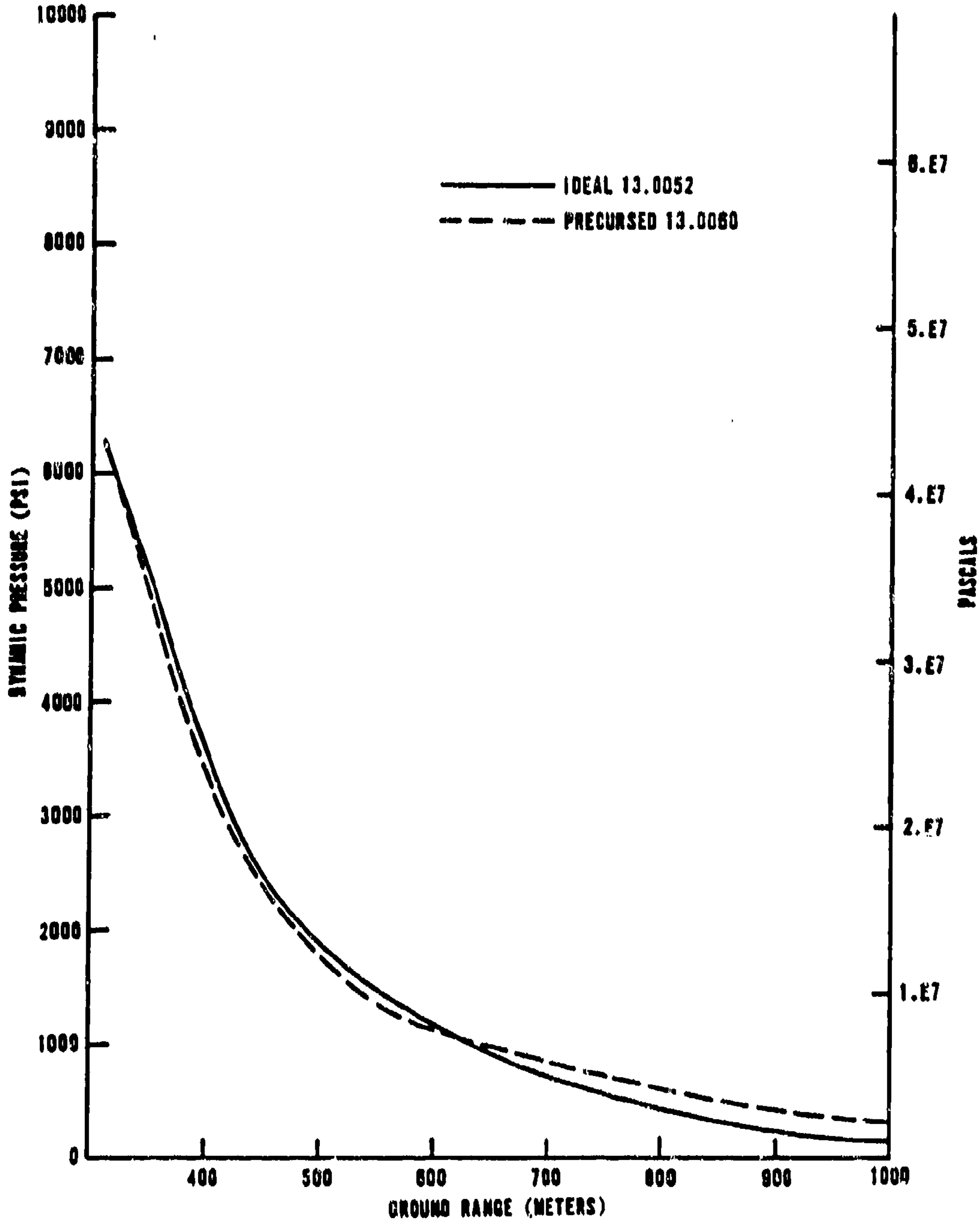


Figure 35c. Dynamic Pressure versus Range for 1000 Feet HOB Ideal and Precursed Cases

The dynamic pressures show a similar effect from the HOB. In all cases the peaks are enhanced because of the heated layer. One important thing to remember in interpreting these curves is that an HOB effect is also seen. That is, the range of some peak overpressure is dependent upon the HOB. For this reason, the pressure distance curves are displaced from one another.

# SECTION VI

# CONCLUSIONS

The heated layer along the ground can have significant effects upon the airblast that results from a nuclear explosion. Using the empirical thermal layer model developed from NTS data, a height of burst study for both ideal and precursed airblast has been completed. The method for including the thermal layer interactively into the calculations has been developed for the HULL code.

The results from the 1-MT surface burst calculations show that the airblast is modified by the thermal layer starting at the 1000-psi level. The HOB study shows that there is an optimum ground range for the precursor as a function of HOB. Moreover, dramatic effects in the static and dynamic overpressures occur as a result. The study has also shown the existence of a hydrodynamic precursor which gives rise to the double peak phenomenon.

The existence of the double peaks in the ideal surface case has been noted by others. Carpenter (ref. 18) noticed double peak waveforms from High Explosive (HE) experiments designed to look at HOB effects. The airblast data from the HOB studies in Canada (ref. 19) also show a double peak effect. There is no reason to believe that nuclear explosions would not exhibit the same behavior. Attributing the cause of the double peaks to the development of a hydrodynamic precursor is a new conclusion which has been shown by this set of calculations.

The thermal layer calculations assume the validity of extrapolating the NTS sound speed data from kiloton to megaton phenomenology. To the extent that the model reflects physically significant features of the actual thermal layer along the ground, the calculations will adequately predict the response of the shock wave as it travels through the thermal layer. One should view the results presented here as trends, but not as absolutes.

## REFERENCES


1. Ganong, G., and Whitaker, W., Nuclear Blast Precursor, AFWL-TR-69-19, Air Force Weapons Laboratory, Kirtland Air Force Base, NM, 1969.

2. Chambers, B., Thermal Layer Predictor, AFWL-TN-76-2, Air Force Weapons Laboratory, Kirtland Air Force Base, NM, 1976.

3. Chambers, B. et al., 1 MT Precursor Calculations, AFWL-TN-75-12, Air Force Weapons Laboratory, Kirtland Air Force Base, NM, 1975.

4. Prentice, J., and Ganong, G., A Thermal Layer Predictor Fit for 10 Kilotons at 500 Feet Height of Burst, AFWL-TR-76-251, Air Force Weapons Laboratory, Kirtland Air Force Base, NM, In press.

5. Ganong, G., Private Communication, 1977.

6. Inn, E. C. Y., Air Temperature Measurements Over Several Surfaces, Weapons Test Report 1142, 1952.

7. Broida, T. R. et al., Air Temperatures in the Vicinity of a Nuclear Detonation, Weapons Test Report 542, U.S. Naval Radiological Defense Laboratory, San Francisco, CA, September 1952.

8. McLoughlin, R. C., Sound Velocity Changes Near the Ground in the Vicinity of an Atomic Explosion, Weapons Test Report 546, U.S. Naval Electronics Laboratory, San Diego, CA, March 1953.

9. McLoughlin, R. C., Preshock Sound Velocities Near the Ground in the Vicinity of an Atomic Explosion, Weapons Test Report 1104, U.S. Naval Electronics Laboratory, San Diego, CA, May 1955.

10. McLoughlin, R. C., and Foushee, F. C., Sound Velocities Near the Ground in the Vicinity of an Atomic Explosion, Weapons Test Report 776, U.S. Naval Electronics Laboratory, San Diego, CA, January 1955.

11. Ganong, G., Private Communication.

12. Knasel, T. M., Private Communication, Science Applications Inc. McLean, VA.

13. Fry, M. et al., HULL Hydrodynamics Code, AFWL-TR-76-183, Air Force Weapons Laboratory, Kirtland Air Force Base, NM, September 1976.

14. Benjamin, H., SPUTTER Users Manual, AFWL-TN-72-7, Air Force Weapons Laboratory, Kirtland Air Force Base, NM, 1972.

15. Clemens, R., and Ganong, G., Private Communication.

16. Sharp, A., A Thermal Source Model from SPUTTER Calculations, AFWL-TR-72-49, Air Force Weapons Laboratory, Kirtland Air Force Base, NM, March 1973.

## REFERENCES (cont'd)

17. Needham, C. et al., Nuclear Blast Standard, AFWL-TR-73-55, Air Force Weapons Laboratory, Kirtland Air Force Base, NM, April 1975.

18. Carpenter, J., Height of Burst Effects at High Overpressures, TRW 20453-6011-RU-00, Redondo Beach, CA, June 1974.

19. Reisler, R., et al., Air Blast Data from Height of Burst Studies in Canada, Volume I Bel 1950, USA Ballistic Research Laboratories, Aberdeen Proving Ground, MD, December 1976.

# APPENDIX A

## AFWL HULL CALCULATION OF 1-MT, IDEAL CASE

Appendixes A and B contain the blast data for all the problems. The abbreviations are:

| | |
|---|---|
| TIME | time in seconds |
| DXPM | radial zone size in meters in the zone of peak overpressure. |
| PMAX | peak overpressure in pascals (i.e., newtons per square meter) |
| XPM | range, in meters, of peak overpressure |
| DPMAX | peak dynamic pressure in pascals |
| XDPM | range, in meters, of the peak dynamic pressure |
| TPMAX | peak total pressure in pascals |
| XTPM | range, in meters, of the peak total pressure |

Each time is followed by the blast data for the leading three local overpressure and dynamic pressure peaks. These abbreviations are:

| | |
|---|---|
| PEAK | local overpressure peak in pascals |
| XPEAK | range, in meters, of local peak overpressure |
| DPPEAK | local dynamic pressure peak in pascals |
| XDPEAK | range, in meters, of the local peak dynamic pressure |

The reader should be aware that the rezone routine caused some trouble with shock definition in three of the problems. In problems 1.0048 and 13.0049, the zone of maximum pressure increased from 5 meters to 9 meters between 0.13 sec and 0.14 sec, so the shock definition after 0.14 sec is poor. This same thing occurred on problem 13.0054 between 0.34 sec and 0.36 sec.

AFWL HULL Calculation of 1 MT Surface Burst Ideal Case

```
PROBLEM NUMBER            13.0143
PRESSURE IN PASCALS       DISTANCE IN METERS

   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0184        2.-1.013E+05         389. 1.117E+08        273. 1.116E+08         273.
              PEAK      XPEAK          DPPEAK      XDPEAK
      0.          0.          0.          0.
      0.          0.          0.          0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0190        2.  2.462E+07        275.  9.047E+07       275.  1.151E+08        275.
              PEAK      XPEAK          DPPEAK      XDPEAK
     1.295E+07 2.310E+02 0.               0.
     1.272E+07 2.145E+02 0.               0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0200        2.  1.986E+07        279.  7.783E+07       281.  9.680E+07        281.
              PEAK      XPEAK          DPPEAK      XDPEAK
     1.162E+07 2.168E+02 0.               0.
     1.195E+07 1.977E+02 0.               0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0210        2.  1.754E+07        287.  7.265E+07       287.  9.019E+07        287.
              PEAK      XPEAK          DPPEAK      XDPEAK
     1.103E+07 2.039E+02 0.               0.
     1.135E+07 1.788E+02 0.               0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0211        2.  1.754E+07        289.  7.213E+07       289.  8.967E+07        289.
              PEAK      XPEAK          DPPEAK      XDPEAK
     1.096E+07 2.009E+02 0.               0.
     1.128E+07 1.788E+02 0.               0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0230        2.  1.938E+07        297.  6.617E+07       297.  8.555E+07        297.
              PEAK      XPEAK          DPPEAK      XDPEAK
     9.861E+06 1.743E+02 0.               0.
     1.020E+07 1.418E+02 0.               0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0250        2.  1.910E+07        307.  5.901E+07       307.  7.812E+07        307.
              PEAK      XPEAK          DPPEAK      XDPEAK
     9.218E+06 2.630E+02 0.               0.
     1.016E+07 4.542E+01 0.               0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0260        2.  1.862E+07        311.  5.562E+07       311.  7.424E+07        311.
              PEAK      XPEAK          DPPEAK      XDPEAK
     8.797E+06 2.670E+02 0.               0.
     9.970E+06 7.772E+01 0.               0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0280        2.  1.745E+07        321.  5.035E+07       321.  6.780E+07        321.
              PEAK      XPEAK          DPPEAK      XDPEAK
     7.809E+06 2.690E+02 0.               0.
     7.666E+06 1.743E+02 0.               0.
```

AFWL HULL Calculation of 1 MT Surface Burst Ideal Case

```
PROBLEM NUMBER           13.0143
PRESSURE IN PASCALS      DISTANCE IN METERS

 TIME     DXPM      PMAX        XPM    DPMAX       XDPM    TPMAX       XTPM
.0300       2.  1.651E+07      329.  4.609E+07     329.  6.260E+07     329.
          PEAK      XPEAK       DPPEAK     XDPEAK
     7.304E+06 1.788E+02 0.              0.
     6.883E+06 6.754E+01 0.              0.
 TIME     DXPM      PMAX        XPM    DPMAX       XDPM    TPMAX       XTPM
.0320       2.  1.550E+07      337.  4.218E+07     337.  5.768E+07     337.
          PEAK      XPEAK       DPPEAK     XDPEAK
     6.724E+06 2.095E+02 0.              0.
     0.        0.        0.              0.
 TIME     DXPM      PMAX        XPM    DPMAX       XDPM    TPMAX       XTPM
.0340       2.  1.453E+07      345.  3.902E+07     345.  5.355E+07     345.
          PEAK      XPEAK       DPPEAK     XDPEAK
     6.080E+06 2.490E+02 0.              0.
     5.972E+06 1.646E+02 0.              0.
 TIME     DXPM      PMAX        XPM    DPMAX       XDPM    TPMAX       XTPM
.0360       2.  1.361E+07      353.  3.651E+07     353.  5.012E+07     353.
          PEAK      XPEAK       DPPEAK     XDPEAK
     5.415E+06 1.943E+02 0.              0.
     5.205E+06 1.051E+02 0.              0.
 TIME     DXPM      PMAX        XPM    DPMAX       XDPM    TPMAX       XTPM
.0380       2.  1.272E+07      361.  3.432E+07     361.  4.704E+07     361.
          PEAK      XPEAK       DPPEAK     XDPEAK
     4.765E+06 1.480E+02 0.              0.
     5.936E+06 7.095E+00 0.              0.
 TIME     DXPM      PMAX        XPM    DPMAX       XDPM    TPMAX       XTPM
.0400       2.  1.197E+07      367.  3.201E+07     369.  4.384E+07     369.
          PEAK      XPEAK       DPPEAK     XDPEAK
     4.871E+06 6.754E+01 0.              0.
     4.946E+06 3.340E+01 0.              0.
 TIME     DXPM      PMAX        XPM    DPMAX       XDPM    TPMAX       XTPM
.0420       2.  1.135E+07      375.  2.998E+07     375.  4.133E+07     375.
          PEAK      XPEAK       DPPEAK     XDPEAK
     4.301E+06 1.077E+02 0.              0.
     4.306E+06 9.097E+01 0.              0.
 TIME     DXPM      PMAX        XPM    DPMAX       XDPM    TPMAX       XTPM
.0450       2.  1.050E+07      385.  2.717E+07     385.  3.767E+07     385.
          PEAK      XPEAK       DPPEAK     XDPEAK
     3.939E+06 2.207E+02 0.              0.
     3.645E+06 9.097E+01 0.              0.
 TIME     DXPM      PMAX        XPM    DPMAX       XDPM    TPMAX       XTPM
.0480       2.  9.802E+06      395.  2.496E+07     395.  3.476E+07     395.
          PEAK      XPEAK       DPPEAK     XDPEAK
     3.807E+06 2.668E+02 0.              0.
     3.251E+06 3.651E+01 0.              0.
```

AFWL HULL Calculation of 1 MT Surface Burst Ideal Case

```
PROBLEM NUMBER            13.0143
PRESSURE IN PASCALS       DISTANCE IN METERS

  TIME      DXPM        PMAX      XPM      DPMAX       XDPM        TPMAX      XTPM
 .0500        2.  9.361E+06     401.  2.375E+07     403.  3.304E+07     403.
            PEAK      XPEAK      DPPEAK     XDPEAK
      3.694E+06 2.970E+02 0.             0.
      3.080E+06 9.337E+00 0.             0.
  TIME      DXPM        PMAX      XPM      DPMAX       XDPM        TPMAX      XTPM
 .0530        2.  8.850E+06     411.  2.194E+07     411.  3.079E+07     411.
            PEAK      XPEAK      DPPEAK     XDPEAK
      3.517E+06 3.230E+02 0.             0.
      3.265E+06 1.377E+02 0.             0.
  TIME      DXPM        PMAX      XPM      DPMAX       XDPM        TPMAX      XTPM
 .0560        2.  8.349E+06     421.  2.056E+07     421.  2.891E+07     421.
            PEAK      XPEAK      DPPEAK     XDPEAK
      3.328E+06 3.410E+02 0.             0.
      3.395E+06 1.237E+01 0.             0.
  TIME      DXPM        PMAX      XPM      DPMAX       XDPM        TPMAX      XTPM
 .0600        2.  7.767E+06     433.  1.877E+07     433.  2.654E+07     433.
            PEAK      XPEAK      DPPEAK     XDPEAK
      3.135E+06 3.630E+02 0.             0.
      3.110E+06 1.012E+02 0.             0.
  TIME      DXPM        PMAX      XPM      DPMAX       XDPM        TPMAX      XTPM
 .0646        2.  7.234E+06     445.  1.692E+07     445.  2.415E+07     445.
            PEAK      XPEAK      DPPEAK     XDPEAK
      2.776E+06 1.667E+02 0.             0.
      2.779E+06 1.461E+02 0.             0.
  TIME      DXPM        PMAX      XPM      DPMAX       XDPM        TPMAX      XTPM
 .0650        2.  7.175E+06     447.  1.692E+07     447.  2.410E+07     447.
            PEAK      XPEAK      DPPEAK     XDPEAK
      2.745E+06 1.854E+02 0.             0.
      2.750E+06 1.667E+02 0.             0.
  TIME      DXPM        PMAX      XPM      DPMAX       XDPM        TPMAX      XTPM
 .0700        2.  6.634E+06     459.  1.529E+07     461.  2.191E+07     461.
            [illegible]  XPEAK   DPPEAK     XDPEAK
      2.504[illegible] [illegible]058E+02 0.             0.
      2.418E+[illegible] [illegible]E+01 0.             0.
  TIME      DXPM     [illegible]AX      XPM      DPMAX       XDPM        TPMAX      XTPM
 .0743        2.  6.26[illegible]6     471.  1.407E+07     471.  2.034E+07     471.
            PEAK      XPEAK      DPPEAK     XDPEAK
      2.374E+06 3.470E+02 0.             0.
      0.        0.        0.             0.
  TIME      DXPM        PMAX      XPM      DPMAX       XDPM        TPMAX      XTPM
 .0750        2.  6.203E+06     473.  1.388E+07     473.  2.009E+07     473.
            PEAK      XPEAK      DPPEAK     XDPEAK
      2.299E+06 3.790E+02 0.             0.
      2.351E+06 3.530E+02 0.             0.
```

AFWL HULL Calculation of 1 MT Surface Burst Ideal Case

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PROBLEM NUMBER          13.0143
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME     DXPM       PMAX      XPM      DPMAX     XDPM     TPMAX      XTPM
.0800       2. 5.769E+06      485. 1.254E+07     487. 1.827E+07     487.
          PEAK      XPEAK     DPPEAK    XDPEAK
     2.230E+06 3.850E+02 0.           0.
     2.229E+06 3.810E+02 0.           0.
 TIME     DXPM       PMAX      XPM      DPMAX     XDPM     TPMAX      XTPM
.0850       2. 5.382E+06      497. 1.142E+07     499. 1.680E+07     499.
          PEAK      XPEAK     DPPEAK    XDPEAK
     2.130E+06 4.030E+02 0.           0.
     2.074E+06 5.804E+01 0.           0.
 TIME     DXPM       PMAX      XPM      DPMAX     XDPM     TPMAX      XTPM
.0900       2. 5.041E+06      509. 1.031E+07     509. 1.535E+07     509.
          PEAK      XPEAK     DPPEAK    XDPEAK
     2.046E+06 4.230E+02 0.           0.
     1.896E+06 3.538E+02 0.           0.
 TIME     DXPM       PMAX      XPM      DPMAX     XDPM     TPMAX      XTPM
.0950       2. 4.729E+06      521. 9.411E+06     521. 1.414E+07     521.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.976E+06 4.410E+02 0.           0.
     1.802E+06 3.729E+02 0.           0.
 TIME     DXPM       PMAX      XPM      DPMAX     XDPM     TPMAX      XTPM
.1000       2. 4.414E+06      533. 8.505E+06     533. 1.292E+07     533.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.729E+06 4.089E+02 0.           0.
     1.706E+06 3.754E+02 0.           0.
 TIME     DXPM       PMAX      XPM      DPMAX     XDPM     TPMAX      XTPM
.1100       2. 3.872E+06      553. 7.024E+06     553. 1.090E+07     553.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.507E+06 2.142E+02 0.           0.
     1.516E+06 1.442E+02 0.           0.
 TIME     DXPM       PMAX      XPM      DPMAX     XDPM     TPMAX      XTPM
.1200       2. 3.410E+06      573. 5.824E+06     573. 9.234E+06     573.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.373E+06 3.766E+02 0.           0.
     1.371E+06 3.295E+02 0.           0.
 TIME     DXPM       PMAX      XPM      DPMAX     XDPM     TPMAX      XTPM
.1220       2. 3.326E+06      577. 5.630E+06     575. 8.954E+06     575.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.349E+06 3.943E+02 0.           0.
     1.348E+06 3.829E+02 0.           0.
 TIME     DXPM       PMAX      XPM      DPMAX     XDPM     TPMAX      XTPM
.1300       2. 3.040E+06      591. 4.930E+06     591. 7.970E+06     591.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.268E+06 4.184E+02 0.           0.
     1.259E+06 3.839E+02 0.           0.
```

AFWL HULL Calculation of 1 MT Surface Burst Ideal Case

```
PROBLEM NUMBER          13.0143
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME     DXPM       PMAX        XPM     DPMAX       XDPM       TPMAX        XTPM
 .1400       2.  2.735E+06      609.  4.221E+06      609.  6.956E+06        609.
          PEAK      XPEAK      DPPEAK      XDPEAK
     1.190E+06  4.534E+02  0.           0.
     1.160E+06  4.028E+02  0.           0.
 TIME     DXPM       PMAX        XPM     DPMAX       XDPM       TPMAX        XTPM
 .1500       2.  2.480E+06      627.  3.682E+06      625.  6.159E+06        625.
          PEAK      XPEAK      DPPEAK      XDPEAK
     1.080E+06  4.463E+02  0.           0.
     1.067E+06  3.906E+02  0.           0.
 TIME     DXPM       PMAX        XPM     DPMAX       XDPM       TPMAX        XTPM
 .1600       2.  2.274E+06      643.  3.252E+06      641.  5.515E+06        641.
          PEAK      XPEAK      DPPEAK      XDPEAK
     9.999E+05  4.505E+02  0.           0.
     9.967E+05  4.368E+02  0.           0.
 TIME     DXPM       PMAX        XPM     DPMAX       XDPM       TPMAX        XTPM
 .1700       2.  2.101E+06      659.  2.911E+06      657.  5.005E+06        659.
          PEAK      XPEAK      DPPEAK      XDPEAK
     2.045E+06  6.670E+02  0.           0.
     9.403E+05  4.747E+02  0.           0.
 TIME     DXPM       PMAX        XPM     DPMAX       XDPM       TPMAX        XTPM
 .1800       2.  1.958E+06      675.  2.641E+06      673.  4.593E+06        675.
          PEAK      XPEAK      DPPEAK      XDPEAK
     1.924E+06  6.830E+02  0.           0.
     8.795E+05  4.799E+02  0.           0.
 TIME     DXPM       PMAX        XPM     DPMAX       XDPM       TPMAX        XTPM
 .1900       2.  1.840E+06      691.  2.424E+06      689.  4.259E+06        691.
          PEAK      XPEAK      DPPEAK      XDPEAK
     1.824E+06  6.970E+02  0.           0.
     8.258E+05  4.908E+02  0.           0.
 TIME     DXPM       PMAX        XPM     DPMAX       XDPM       TPMAX        XTPM
 .2000       2.  1.740E+06      707.  2.252E+06      705.  3.988E+06        705.
          PEAK      XPEAK      DPPEAK      XDPEAK
     1.737E+06  7.130E+02  0.           0.
     7.777E+05  4.929E+02  0.           0.
 TIME     DXPM       PMAX        XPM     DPMAX       XDPM       TPMAX        XTPM
 .2100       2.  1.662E+06      727.  2.115E+06      721.  3.770E+06        721.
          PEAK      XPEAK      DPPEAK      XDPEAK
     1.655E+06  7.210E+02  0.           0.
     7.314E+05  4.946E+02  0.           0.
 TIME     DXPM       PMAX        XPM     DPMAX       XDPM       TPMAX        XTPM
 .2208       2.  1.581E+06      741.  1.995E+06      737.  3.571E+06        737.
          PEAK      XPEAK      DPPEAK      XDPEAK
     1.576E+06  7.370E+02  1.983E+06  7.410E+02
     6.934E+05  5.066E+02  0.           0.
```

AFWL HULL Calculation of 1 MT Surface Burst Ideal Case

```
PROBLEM NUMBER          13.0143
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.2300        2. 1.525E+06      755. 1.909E+06      749. 3.425E+06      749.
           PEAK     XPEAK      DPPEAK     XDPEAK
    1.516E+06 7.490E+02 0.            0.
    6.643E+05 5.102E+02 0.            0.
 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.2500        2. 1.418E+06      781. 1.755E+06      779. 3.170E+06      781.
           PEAK     XPEAK      DPPEAK     XDPEAK
    5.981E+05 5.192E+02 0.            0.
    5.905E+05 4.662E+02 0.            0.
 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.2600        2. 1.366E+06      793. 1.694E+06      793. 3.060E+06      793.
           PEAK     XPEAK      DPPEAK     XDPEAK
    5.692E+05 5.274E+02 0.            0.
    5.616E+05 4.862E+02 0.            0.
 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.2800        2. 1.278E+06      819. 1.570E+06      817. 2.844E+06      817.
           PEAK     XPEAK      DPPEAK     XDPEAK
    5.215E+05 5.572E+02 0.            0.
    5.221E+05 5.326E+02 0.            0.
 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.3000        2. 1.200E+06      843. 1.461E+06      841. 2.657E+06      841.
           PEAK     XPEAK      DPPEAK     XDPEAK
    4.782E+05 5.362E+02 0.            0.
    4.694E+05 5.034E+02 0.            0.
```

AFWL HULL Calculation of 1 MT at 500 Feet Ideal Surface

```
PROBLEM NUMBER          13.0049
PRESSURE IN PASCALS     DISTANCE IN METERS

  TIME     DXPM       PMAX       XPM     DPMAX       XDPM       TPMAX      XTPM
 .0042       2.-1.013E+05       239. 5.597E-04       1. 0.                   0.
           PEAK     XPEAK      DPPEAK    XDPEAK
   0.           0.           8.312E-05 9.335E-05
   0.           0.           8.926E-05 9.736E-05
  TIME     DXPM       PMAX       XPM     DPMAX       XDPM       TPMAX      XTPM
 .0042       2. 1.123E+03       239. 5.598E-04      21. 1.123E+03       239.
           PEAK     XPEAK      DPPEAK    XDPEAK
   -2.866E+02 1.370E+02 1.367E-04 9.066E-05
   0.           0.           8.409E-05 9.588E-05
  TIME     DXPM       PMAX       XPM     DPMAX       XDPM       TPMAX      XTPM
 .0043       2. 1.123E+03       239. 2.492E-03     157. 1.123E+03       239.
           PEAK     XPEAK      DPPEAK    XDPEAK
   -2.863E+02 1.370E+02 5.578E-04 5.560E-04
   -2.590E+01 2.100E+01 5.560E-04 5.000E+00
  TIME     DXPM       PMAX       XPM     DPMAX       XDPM       TPMAX      XTPM
 .0045       2. 1.123E+03       239. 9.555E-03     157. 1.123E+03       239.
           PEAK     XPEAK      DPPEAK    XDPEAK
   -2.860E+02 1.370E+02 0.           0.
   -2.467E+01 2.100E+01 0.           0.
  TIME     DXPM       PMAX       XPM     DPMAX       XDPM       TPMAX      XTPM
 .0048       2. 1.123E+03       239. 3.338E-02     157. 1.123E+03       239.
           PEAK     XPEAK      DPPEAK    XDPEAK
   -2.135E+01 3.000E+00 0.           0.
                0.           0.           0.
  TIME     DXPM       PMAX       XPM     DPMAX       XDPM       TPMAX      XTPM
 .0050       2. 1.123E+03       239. 5.676E-02     157. 1.123E+03       239.
           PEAK     XPEAK      DPPEAK    XDPEAK
   -[illegible].842E+01 3.000E+00 0.           0.
   0.           0.           0.           0.
  TIME     DXPM       PMAX       XPM     DPMAX       XDPM       TPMAX      XTPM
 .0053       2. 2.596F+06         3. 2.094E+06       3. 4.691E+06         3.
           PEAK     XPEAK      DPPEAK    XDPEAK
   0.           0.           0.           0.
   0.           0.           0.           0.
  TIME     DXPM       PMAX       XPM     DPMAX       XDPM       TPMAX      XTPM
 .0055       2. 1.820E+08         1. 4.329E+08       1. 6.149E+08         1.
           PEAK     XPEAK      DPPEAK    XDPEAK
   0.           0.           0.           0.
   0.           0.           0.           0.
  TIME     DXPM       PMAX       XPM     DPMAX       XDPM       TPMAX      XTPM
 .0056       2. 3.914F+08         1. 5.653E+08       7. 9.514E+08         1.
           PEAK     XPEAK      DPPEAK    XDPEAK
   0.           0.           5.600E+08 1.000E+00
   0.           0.           0.           0.
```

AFWL HULL Calculation of 1 MT at 500 Feet Ideal Surface

```
PROBLEM NUMBER           13.0049
PRESSURE IN PASCALS      DISTANCE IN METERS

  TIME      DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX     XTPM
 .0060        2.  1.014E+09        7.  5.566E+08      33.  1.096E+09      27.
            PEAK      XPEAK     DPPEAK     XDPEAK
     9.994E+08  1.300E+01  0.          0.
     0.         0.         0.          0.
  TIME      DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX     XTPM
 .0065        2.  1.027E+09       39.  5.793E+08      51.  1.219E+09      43.
            PEAK      XPEAK     DPPEAK     XDPEAK
     4.438E+08  3.000E+00  0.          0.
     0.         0.         0.          0.
  TIME      DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX     XTPM
 .0070        2.  1.012E+09       57.  6.231E+08      63.  1.360E+09      59.
            PEAK      XPEAK     DPPEAK     XDPEAK
     0.         0.         0.          0.
     0.         0.         0.          0.
  TIME      DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX     XTPM
 .0075        2.  9.324E+08       69.  6.452E+08      75.  1.394E+09      71.
            PEAK      XPEAK     DPPEAK     XDPEAK
     9.983E+07  1.000E+00  0.          0.
     0.         0.         0.          0.
  TIME      DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX     XTPM
 .0080        2.  8.264E+08       81.  6.195E+08      85.  1.345E+09      81.
            PEAK      XPEAK     DPPEAK     XDPEAK
     0.         0.         0.          0.
     0.         0.         0.          0.
  TIME      DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX     XTPM
 .0085        2.  7.204E+08       91.  6.019E+08      93.  1.281E+09      91.
            PEAK      XPEAK     DPPEAK     XDPEAK
     0.         0.         0.          0.
     0.         0.         0.          0.
  TIME      DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX     XTPM
 .0090        2.  6.245E+08       99.  5.884E+08     101.  1.167E+09      99.
            PEAK      XPEAK     DPPEAK     XDPEAK
     0.         0.         0.          0.
     0.         0.         0.          0.
  TIME      DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX     XTPM
 .0095        2.  5.443E+08      107.  5.657E+08     109.  1.087E+09     107.
            PEAK      XPEAK     DPPEAK     XDPEAK
     0.         0.         0.          0.
     0.         0.         0.          0.
  TIME      DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX     XTPM
 .0100        2.  4.775E+08      115.  5.509E+08     115.  1.028E+09     115.
            PEAK      XPEAK     DPPEAK     XDPEAK
     0.         0.         0.          0.
     0.         0.         0.          0.
```

AFWL HULL Calculation of 1 MT at 500 Feet Ideal Surface

PROBLEM NUMBER 13.0049
PRESSURE IN PASCALS DISTANCE IN METERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0110 | 2. | 3.629E+08 | 127. | 4.894E+08 | 127. | 8.523E+08 | 127. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0120 | 2. | 2.836E+08 | 139. | 4.824E+08 | 139. | 7.659E+08 | 139. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0130 | 2. | 2.241E+08 | 149. | 4.639E+08 | 149. | 6.880E+08 | 149. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0140 | 2. | 1.909E+08 | 157. | 4.400E+08 | 157. | 6.309E+08 | 157. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0150 | 2. | 1.610E+08 | 165. | 4.258E+08 | 167. | 5.713E+08 | 165. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0151 | 2. | 1.552E+08 | 165. | 4.240E+08 | 167. | 5.769E+08 | 167. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0160 | 1. | 1.368E+08 | 172. | 4.185E+08 | 175. | 5.437E+08 | 175. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0170 | 1. | 1.213E+08 | 180. | 3.930E+08 | 182. | 5.065E+08 | 182. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0180 | 1. | 1.059E+08 | 187. | 3.598E+08 | 190. | 4.569E+08 | 189. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |

AFWL HULL Calculation of 1 MT at 500 Feet Ideal Surface

PROBLEM NUMBER 13.0049
PRESSURE IN PASCALS DISTANCE IN METERS

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .0190 | 1. | 9.357E+07 | 193. | 3.260E+08 | 196. | 4.098E+08 | 196. |

| PEAK | XPEAK | DPPEAK | XDPEAK |
|---|---|---|---|
| 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. |

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .0200 | 1. | 8.262E+07 | 198. | 2.934E+08 | 203. | 3.648E+08 | 201. |

| PEAK | XPEAK | DPPEAK | XDPEAK |
|---|---|---|---|
| 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. |

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .0210 | 1. | 7.390E+07 | 206. | 2.673E+08 | 209. | 3.313E+08 | 209. |

| PEAK | XPEAK | DPPEAK | XDPEAK |
|---|---|---|---|
| 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. |

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .0230 | 2. | 5.980E+07 | 216. | 2.202E+08 | 221. | 2.715E+08 | 221. |

| PEAK | XPEAK | DPPEAK | XDPEAK |
|---|---|---|---|
| 0. | 0. | 0. | 0. |
| 0. | 0. | 0. | 0. |

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .0250 | 2. | 4.828E+07 | 228. | 1.814E+08 | 233. | 2.222E+08 | 231. |

| PEAK | XPEAK | DPPEAK | XDPEAK |
|---|---|---|---|
| 2.436E+07 | 2.432E+02 | 0. | 0. |
| 0. | 0. | 0. | 0. |

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .0260 | 2. | 4.413E+07 | 233. | 1.659E+08 | 239. | 2.032E+08 | 237. |

| PEAK | XPEAK | DPPEAK | XDPEAK |
|---|---|---|---|
| 2.355E+07 | 2.492E+02 | 0. | 0. |
| 0. | 0. | 0. | 0. |

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .0280 | 2. | 3.681E+07 | 243. | 1.387E+08 | 249. | 1.693E+08 | 249. |

| PEAK | XPEAK | DPPEAK | XDPEAK |
|---|---|---|---|
| 2.204E+07 | 2.618E+02 | 0. | 0. |
| 0. | 0. | 0. | 0. |

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .0300 | 2. | 3.092E+07 | 252. | 1.168E+08 | 260. | 1.422E+08 | 259. |

| PEAK | XPEAK | DPPEAK | XDPEAK |
|---|---|---|---|
| 2.093E+07 | 2.745E+02 | 0. | 0. |
| 0. | 0. | 0. | 0. |

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .0320 | 2. | 2.610E+07 | 262. | 9.928E+07 | 271. | 1.204E+08 | 270. |

| PEAK | XPEAK | DPPEAK | XDPEAK |
|---|---|---|---|
| 1.980E+07 | 2.856E+02 | 9.770E+07 | 2.808E+02 |
| 0. | 0. | 0. | 0. |

AFWL HULL Calculation of 1 MT at 500 Feet Ideal Surface

```
PROBLEM NUMBER            13.0049
PRESSURE IN PASCALS       DISTANCE IN METERS

 TIME      DXPM        PMAX        XPM    DPMAX      XDPM      TPMAX      XTPM
.0340        2.  2.223E+07      270.  8.721E+07     293.  1.045E+08      294.
           PEAK      XPEAK      DPPEAK     XDPEAK
    1.829E+07  2.960E+02  0.            0.
    0.         0.         0.            0.
 TIME      DXPM        PMAX        XPM    DPMAX      XDPM      TPMAX      XTPM
.0360        2.  1.922E+07      279.  7.754E+07     305.  9.437E+07      305.
           PEAK      XPEAK      DPPEAK     XDPEAK
    1.736E+07  3.065E+02  0.            0.
    0.         0.         0.            0.
 TIME      DXPM        PMAX        XPM    DPMAX      XDPM      TPMAX      XTPM
.0380        2.  1.681E+07      287.  6.958E+07     315.  8.567E+07      315.
           PEAK      XPEAK      DPPEAK     XDPEAK
    1.643E+07  3.170E+02  0.            0.
    0.         0.         0.            0.
 TIME      DXPM        PMAX        XPM    DPMAX      XDPM      TPMAX      XTPM
.0400        2.  1.505E+07      325.  6.203E+07     323.  7.691E+07      325.
           PEAK      XPEAK      DPPEAK     XDPEAK
    1.479E+07  2.945E+02  0.            0.
    0.         0.         0.            0.
 TIME      DXPM        PMAX        XPM    DPMAX      XDPM      TPMAX      XTPM
.0420        2.  1.392E+07      335.  5.526E+07     333.  6.877E+07      333.
           PEAK      XPEAK      DPPEAK     XDPEAK
    1.319E+07  3.026E+02  0.            0.
    0.         0.         0.            0.
 TIME      DXPM        PMAX        XPM    DPMAX      XDPM      TPMAX      XTPM
.0450        2.  1.312E+07      349.  4.769E+07     347.  6.040E+07      347.
           PEAK      XPEAK      DPPEAK     XDPEAK
    1.127E+07  3.147E+02  0.            0.
    1.415E+06  7.447E+01  0.            0.
 TIME      DXPM        PMAX        XPM    DPMAX      XDPM      TPMAX      XTPM
.0480        2.  1.209E+07      363.  4.134E+07     361.  5.332E+07      361.
           PEAK      XPEAK      DPPEAK     XDPEAK
    9.762E+06  3.244E+02  0.            0.
    1.776E+06  9.928E+01  0.            0.
 TIME      DXPM        PMAX        XPM    DPMAX      XDPM      TPMAX      XTPM
.0500        2.  1.145E+07      371.  3.755E+07     369.  4.883E+07      369.
           PEAK      XPEAK      DPPEAK     XDPEAK
    8.901E+06  3.304E+02  0.            0.
    1.621E+06  9.928E+01  0.            0.
 TIME      DXPM        PMAX        XPM    DPMAX      XDPM      TPMAX      XTPM
.0530        2.  1.074E+07      383.  3.289E+07     381.  4.348E+07      381.
           PEAK      XPEAK      DPPEAK     XDPEAK
    7.814E+06  3.405E+02  0.            0.
    4.380E+06  8.132E+01  0.            0.
```

AFWL HULL Calculation of 1 MT at 500 Feet Ideal Surface

```
PROBLEM NUMBER          13.0049
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0560       2.   9.972E+06      393.  2.895E+07     393.  3.892E+07      393.
          PEAK      XPEAK       DPPEAK     XDPEAK
     6.957E+06  3.506E+02  0.           0.
     4.381E+06  9.928E+01  0.           0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0600       2.   9.010E+06      408.  2.422E+07     408.  3.323E+07      408.
          PEAK      XPEAK       DPPEAK     XDPEAK
     6.076E+06  3.636E+02  0.           0.
     4.346E+06  1.199E+02  0.           0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0650       2.   8.037E+06      424.  1.983E+07     424.  2.787E+07      424.
          PEAK      XPEAK       DPPEAK     XDPEAK
     5.208E+06  3.800E+02  0.           0.
     4.089E+06  1.377E+02  0.           0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0700       2.   7.323E+06      441.  1.659E+07     441.  2.372E+07      441.
          PEAK      XPEAK       DPPEAK     XDPEAK
     4.003E+06  1.541E+02  0.           0.
     3.684E+06  3.313E+01  0.           0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0750       3.   6.497E+06      454.  1.375E+07     457.  2.024E+07      457.
          PEAK      XPEAK       DPPEAK     XDPEAK
     3.821E+06  1.646E+02  0.           0.
     3.653E+06  7.124E+01  0.           0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0800       3.   6.004E+06      471.  1.201E+07     471.  1.801E+07      471.
          PEAK      XPEAK       DPPEAK     XDPEAK
     3.518E+06  1.853E+02  0.           0.
     3.528E+06  7.124E+01  0.           0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0850       3.   5.500E+06      481.  1.062E+07     484.  1.610E+07      484.
          PEAK      XPEAK       DPPEAK     XDPEAK
     3.193E+06  1.980E+02  0.           0.
     3.325E+06  9.056E+01  0.           0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0900       3.   5.045E+06      496.  9.154E+06     496.  1.420E+07      496.
          PEAK      XPEAK       DPPEAK     XDPEAK
     2.921E+06  2.163E+02  0.           0.
     3.083E+06  8.131E+01  0.           0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0950       3.   4.648E+06      507.  8.267E+06     510.  1.282E+07      507.
          PEAK      XPEAK       DPPEAK     XDPEAK
     2.709E+06  2.317E+02  0.           0.
     2.897E+06  6.779E+01  0.           0.
```

AFWL HULL Calculation of 1 MT at 500 Feet Ideal Surface

```
PROBLEM NUMBER            13.0049
PRESSURE IN PASCALS       DISTANCE IN METERS

 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.1000        3. 4.320E+06      519. 7.512E+06     522. 1.180E+07      519.
          PEAK      XPEAK      DPPEAK     XDPEAK
     2.523E+06 2.458E+02 0.         0.
     2.618E+06 9.431E+01 0.         0.
 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.1100        3. 3.778E+06      543. 6.379E+06     543. 1.016E+07      543.
          PEAK      XPEAK      DPPEAK     XDPEAK
     2.227E+06 2.729E+02 3.516E+06 5.119E+02
     2.163E+06 2.149E+02 0.         0.
 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.1200        3. 3.351E+06      564. 5.484E+06     564. 8.836E+06      564.
          PEAK      XPEAK      DPPEAK     XDPEAK
     2.001E+06 3.083E+02 2.684E+06 5.257E+02
     1.567E+06 2.122E+01 0.         0.
 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.1300        3. 3.039E+06      581. 4.836E+06     584. 7.779E+06      584.
          PEAK      XPEAK      DPPEAK     XDPEAK
     1.823E+06 3.333E+02 2.079E+06 5.395E+02
     1.125E+06 2.122E+01 0.         0.
 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.1400        8. 2.753E+06      595. 3.732E+06     595. 6.485E+06      595.
          PEAK      XPEAK      DPPEAK     XDPEAK
     1.830E+06 3.453E+02 1.614E+06 5.533E+02
     7.774E+05 2.912E+01 0.         0.
 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.1500        8. 2.410E+06      612. 3.128E+06     612. 5.538E+06      612.
          PEAK      XPEAK      DPPEAK     XDPEAK
     1.771E+06 3.869E+02 4.119E+05 3.952E+02
     8.395E+05 2.704E+02 0.         0.
 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.1600        8. 2.181E+06      628. 2.776E+06     628. 4.957E+06      628.
          PEAK      XPEAK      DPPEAK     XDPEAK
     1.635E+06 4.202E+02 4.011E+05 4.285E+02
     7.932E+05 3.037E+02 0.         0.
 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.1700        8. 2.013E+06      645. 2.567E+06     645. 4.579E+06      645.
          PEAK      XPEAK      DPPEAK     XDPEAK
     1.513E+06 4.535E+02 3.905E+05 4.535E+02
     5.111E+05 4.161E+00 0.         0.
 TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.1800        8. 1.865E+06      662. 2.435E+06     662. 4.300E+06      662.
          PEAK      XPEAK      DPPEAK     XDPEAK
     1.390E+06 4.785E+02 3.848E+05 4.868E+02
     5.518E+05 4.161E+00 0.         0.
```

AFWL HULL Calculation of 1 MT at 500 Feet Ideal Surface

```
PROBLEM NUMBER          13.0049
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME     DXPM       PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
.1900       8. 1.737E+06      670. 2.334E+06      678. 4.054E+06      678.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.286E+06 5.034E+02 3.825E+05 5.117E+02
     6.511E+05 4.161E+00 0.        0.
 TIME     DXPM       PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
.2000       8. 1.648E+06      686. 2.225E+06      695. 3.796E+06      695.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.207E+06 5.367E+02 3.852E+05 5.450E+02
     7.035E+05 4.161E+00 0.        0.
 TIME     DXPM       PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
.2100       8. 1.556E+06      703. 2.061E+06      711. 3.563E+06      703.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.139E+06 5.617E+02 3.955E+05 5.700E+02
     7.691E+05 4.161E+00 0.        0.
 TIME     DXPM       PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
.2300       8. 1.404E+06      728. 1.951E+06      736. 3.283E+06      736.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.027E+06 6.116E+02 3.818E+05 6.116E+02
     7.710E+05 1.706E+02 0.        0.
 TIME     DXPM       PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
.2500       8. 1.273E+06      753. 1.775E+06      761. 3.003E+06      761.
          PEAK      XPEAK     DPPEAK    XDPEAK
     7.957E+05 2.538E+02 3.034E+05 6.449E+02
     8.406E+05 4.161E+00 0.        0.
 TIME     DXPM       PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
.2600       8. 1.216E+06      761. 1.660E+06      778. 2.811E+06      770.
          PEAK      XPEAK     DPPEAK    XDPEAK
     7.497E+05 2.871E+02 2.562E+05 6.532E+02
     8.629E+05 4.161E+00 0.        0.
 TIME     DXPM       PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
.2800       8. 1.128E+06      786. 1.518E+06      803. 2.590E+06      795.
          PEAK      XPEAK     DPPEAK    XDPEAK
     6.368E+05 3.453E+02 0.        0.
     7.793E+05 4.161E+00 0.        0.
 TIME     DXPM       PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
.3000       8. 1.060E+06      811. 1.383E+06      820. 2.431E+06      820.
          PEAK      XPEAK     DPPEAK    XDPEAK
     4.751E+05 5.284E+02 0.        0.
     5.557E+05 3.952E+02 0.        0.
 TIME     DXPM       PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
.3200       8. 1.005E+06      836. 1.314E+06      845. 2.305E+06      845.
          PEAK      XPEAK     DPPEAK    XDPEAK
     5.009E+05 4.452E+02 0.        0.
     4.670E+05 4.161E+00 0.        0.
```

AFWL HULL Calculation of 1 MT at 500 Feet Ideal Surface

```
PROBLEM NUMBER          13.0049
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.3400       8. 9.598E+05      861. 1.245E+06      870. 2.184E+06      870.
          PEAK     XPEAK      DPPEAK     XDPEAK
     4.604E+05 4.868E+02 0.          0.
     3.306E+05 6.241E+01 0.          0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.3600       8. 9.199E+05      886. 1.151E+06      895. 2.031E+06      895.
          PEAK     XPEAK      DPPEAK     XDPEAK
     4.311E+05 5.284E+02 0.          0.
     0.        0.        0.          0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.3800       8. 8.807E+05      911. 1.080E+06      911. 1.960E+06      911.
          PEAK     XPEAK      DPPEAK     XDPEAK
     4.117E+05 5.700E+02 0.          0.
     3.296E+05 4.285E+02 0.          0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.4000       8. 8.524E+05      928. 1.026E+06      936. 1.856E+06      936.
          PEAK     XPEAK      DPPEAK     XDPEAK
     3.967E+05 6.116E+02 0.          0.
     3.177E+05 4.785E+02 0.          0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.4200       4. 8.156E+05      951. 9.928E+05      960. 1.802E+06      956.
          PEAK     XPEAK      DPPEAK     XDPEAK
     1.123E+03 1.102E+03 0.          0.
     1.123E+03 1.088E+03 0.          0.
```

AFWL HULL Calculation of 1 MT at 750 Feet HOB - Ideal Surface

```
PROBLEM NUMBER            13.0054
PRESSURE IN PASCALS       DISTANCE IN METERS

  TIME      DXPM         PMAX        XPM      DPMAX        XDPM        TPMAX        XTPM
 .0103         2.-1.013E+05        239. 1.571E-05         1. 0.                      0.
            PEAK       XPEAK         DPPEAK     XDPEAK
    0.            0.             4.786E-06 2.370E+02
    0.            0.             0.          0.
  TIME      DXPM         PMAX        XPM      DPMAX        XDPM        TPMAX        XTPM
 .0110         2. 1.123E+03        239. 6.807E-02        237. 1.123E+03         239.
            PEAK       XPEAK         DPPEAK     XDPEAK
   -1.080E+03 2.350E+02 0.                   0.
   -1.045E+03 1.000E+00 0.                   0.
  TIME      DXPM         PMAX        XPM      DPMAX        XDPM        TPMAX        XTPM
 .0120         2. 1.123E+03        239. 3.780E-01        237. 1.123E+03         239.
            PEAK       XPEAK         DPPEAK     XDPEAK
   -1.060E+03 2.350E+02 0.                   0.
   -1.084E+03 2.310E+02 0.                   0.
  TIME      DXPM         PMAX        XPM      DPMAX        XDPM        TPMAX        XTPM
 .0130         2. 1.123E+03        239. 9.292E-01        237. 1.123E+03         239.
            PEAK       XPEAK         DPPEAK     XDPEAK
   -1.024E+03 2.350E+02 0.                   0.
   -1.083E+03 2.310E+02 0.                   0.
  TIME      DXPM         PMAX        XPM      DPMAX        XDPM        TPMAX        XTPM
 .0140         2. 1.123E+03        239. 1.705E+00        237. 1.123E+03         239.
            PEAK       XPEAK         DPPEAK     XDPEAK
   -9.727E+02 2.350E+02 0.                   0.
   -1.082E+03 2.310E+02 0.                   0.
  TIME      DXPM         PMAX        XPM      DPMAX        XDPM        TPMAX        XTPM
 .0150         2. 1.123E+03        239. 2.681E+00        237. 1.123E+03         239.
            PEAK       XPEAK         DPPEAK     XDPEAK
   -9.074E+02 2.350E+02 0.                   0.
   -1.081E+03 2.310E+02 0.                   0.
  TIME      DXPM         PMAX        XPM      DPMAX        XDPM        TPMAX        XTPM
 .0160         2. 2.388E+07          1. 4.734E+07          1. 7.122E+07           1.
            PEAK       XPEAK         DPPEAK     XDPEAK
    0.            0.             0.          0.
    0.            0.             0.          0.
  TIME      DXPM         PMAX        XPM      DPMAX        XDPM        TPMAX        XTPM
 .0170         1. 3.024E+08          2. 1.614E+08         37. 3.420E+08          25.
            PEAK       XPEAK         DPPEAK     XDPEAK
    0.            0.             0.          0.
    0.            0.             0.          0.
  TIME      DXPM         PMAX        XPM      DPMAX        XDPM        TPMAX        XTPM
 .0180         1. 2.956E+08         45. 1.584E+08         60. 3.427E+08          53.
            PEAK       XPEAK         DPPEAK     XDPEAK
    1.306E+08 8.121E+00 0.                   0.
    0.            0.             0.          0.
```

AFWL HULL Calculation of 1 MT at 750 Feet HOB - Ideal Surface

```
PROBLEM NUMBER            13.0054
PRESSURE IN PASCALS       DISTANCE IN METERS

 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0190       1. 2.799E+08       67. 1.569E+08       77. 3.475E+08       70.
          PEAK      XPEAK      DPPEAK     XDPEAK
   1.450E+08 3.685E+01 1.727E+07 4.835E+01
   0.        0.        0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0200       1. 2.615E+08       84. 1.583E+08       91. 3.527E+08       84.
          PEAK      XPEAK      DPPEAK     XDPEAK
   1.329E+08 6.271E+01 2.571E+07 6.990E+01
   5.481E+07 5.247E+00 0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0210       2. 2.373E+08       98. 1.401E+08      103. 3.411E+08       98.
          PEAK      XPEAK      DPPEAK     XDPEAK
   1.181E+08 8.050E+01 0.        0.
   0.        0.        0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0230       2. 2.008E+08      121. 1.421E+08      124. 3.263E+08      121.
          PEAK      XPEAK      DPPEAK     XDPEAK
   1.028E+08 1.067E+02 0.        0.
   0.        0.        0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0250       2. 1.654E+08      140. 1.363E+08      142. 2.962E+08      140.
          PEAK      XPEAK      DPPEAK     XDPEAK
   8.818E+07 1.282E+02 0.        0.
   0.        0.        0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0260       2. 1.434E+08      147. 1.343E+08      149. 2.763E+08      149.
          PEAK      XPEAK      DPPEAK     XDPEAK
   8.215E+07 1.378E+02 0.        0.
   0.        0.        0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0280       2. 1.208E+08      164. 1.267E+08      164. 2.475E+08      164.
          PEAK      XPEAK      DPPEAK     XDPEAK
   0.        0.        0.        0.
   0.        0.        0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0300       2. 1.035E+08      178. 1.213E+08      178. 2.248E+08      178.
          PEAK      XPEAK      DPPEAK     XDPEAK
   0.        0.        0.        0.
   0.        0.        0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
.0320       2. 8.722E+07      190. 1.158E+08      190. 2.030E+08      190.
          PEAK      XPEAK      DPPEAK     XDPEAK
   0.        0.        0.        0.
   0.        0.        0.        0.
```

```
PROBLEM NUMBER              13.0054
PRESSURE IN PASCALS         DISTANCE IN METERS

   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0340        2.   6.808E+07       201.  1.033E+08       201.   1.714E+08       201.
             PEAK       XPEAK      DPPEAK      XDPEAK
     0.        0.          0.          0.
     0.        0.          0.          0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0360        2.   5.966E+07       212.  1.044E+08       212.   1.641E+08       212.
             PEAK       XPEAK      DPPEAK      XDPEAK
     0.        0.          0.          0.
     0.        0.          0.          0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0380        2.   5.508E+07       220.  1.070E+08       220.   1.621E+08       220.
             PEAK       XPEAK      DPPEAK      XDPEAK
     0.        0.          0.          0.
     0.        0.          0.          0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0400        2.   4.957E+07       229.  1.106E+08       232.   1.565E+08       229.
             PEAK       XPEAK      DPPEAK      XDPEAK
     0.        0.          0.          0.
     0.        0.          0.          0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0420        2.   4.416E+07       238.  1.101E+08       240.   1.510E+08       238.
             PEAK       XPEAK      DPPEAK      XDPEAK
     0.        0.          0.          0.
     0.        0.          0.          0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0450        2.   3.628E+07       249.  1.008E+08       253.   1.359E+08       251.
             PEAK       XPEAK      DPPEAK      XDPEAK
     0.        0.          0.          0.
     0.        0.          0.          0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0480        2.   3.115E+07       260.  9.326E+07       265.   1.226E+08       263.
             PEAK       XPEAK      DPPEAK      XDPEAK
     0.        0.          0.          0.
     0.        0.          0.          0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0500        2.   2.816E+07       267.  8.760E+07       272.   1.126E+08       270.
             PEAK       XPEAK      DPPEAK      XDPEAK
     0.        0.          0.          0.
     0.        0.          0.          0.
     0.        0.          0.          0.
   TIME      DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX       XTPM
  .0530        2.   2.471E+07       277.  7.891E+07       281.   1.012E+08       281.
             PEAK       XPEAK      DPPEAK      XDPEAK
     0.        0.          0.          0.
     0.        0.          0.          0.
```

AFWL HULL Calculation of 1 MT at 750 Feet HOB - Ideal Surface

```
PROBLEM NUMBER          13.0054
PRESSURE IN PASCALS     DISTANCE IN METERS

  TIME     DXPM         PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0560       2.  2.225E+07      287.  7.161E+07      292.  9.076E+07      292.
           PEAK      XPEAK      DPPEAK    XDPEAK
     0.         0.         0.         0.
     0.         0.         0.         0.
  TIME     DXPM         PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0600       2.  2.020E+07      299.  6.529E+07      306.  8.280E+07      304.
           PEAK      XPEAK      DPPEAK    XDPEAK
     0.         0.         0.         0.
     0.         0.         0.         0.
  TIME     DXPM         PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0650       2.  1.775E+07      313.  5.836E+07      [illegible]  7.381E+07      320.
           PEAK      XPEAK      DPPEAK    XDPEAK
     0.         0.         0.         0.
     0.         0.         0.
  TIME     DXPM         PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0700       2.  1.517E+07      328.  5.142E+07      337.  6.429E+07      335.
           PEAK      XPEAK      DPPEAK    XDPEAK
     0.         0.         0.         0.
     0.         0.         0.         0.
  TIME     DXPM         PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0750       2.  1.287E+07      342.  4.448E+07      354.  5.536E+07      352.
           PEAK      XPEAK      DPPEAK    XDPEAK
     0.         0.         0.         0.
     0.         0.         0.         0.
  TIME     DXPM         PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0800       2.  1.100E+07      356.  3.857E+07      368.  4.770E+07      366.
           PEAK      XPEAK      DPPEAK    XDPEAK
     6.196E+06  3.866E+02  0.         0.
     0.         0.         0.         0.
  TIME     DXPM         PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0850       3.  9.420E+06      370.  3.305E+07      383.  4.077E+07      381.
           PEAK      XPEAK      DPPEAK    XDPEAK
     5.759E+06  4.012E+02  0.         0.
     0.         0.         0.         0.
  TIME     DXPM         PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0900       3.  8.092E+06      382.  2.839E+07      401.  3.489E+07      395.
           PEAK      XPEAK      DPPEAK    XDPEAK
     5.334E+06  4.170E+02  0.         0.
     0.         0.         0.         0.
  TIME     DXPM         PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0950       3.  7.028E+06      395.  2.456E+07      414.  3.009E+07      409.
           PEAK      XPEAK      DPPEAK    XDPEAK
     5.164E+06  4.332E+02  0.         0.
     0.         0.         0.         0.
```

## AFWL HULL Calculation of 1 MT at 750 Feet HOB - Ideal Surface

```
PROBLEM NUMBER          13.0054
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME     DXPM        PMAX       XPM     DPMAX       XDPM      TPMAX      XTPM
.1000       3. 6.170E+06      406. 2.221E+07     441. 2.688E+07     444.
          PEAK      XPEAK     DPPEAK     XDPEAK
     4.912E+06 4.495E+02 0.          0.
     0.        0.        0.          0.
 TIME     DXPM        PMAX       XPM     DPMAX       XDPM      TPMAX      XTPM
.1100       3. 4.923E+06      431. 1.855E+07     471. 2.282E+07     471.
          PEAK      XPEAK     DPPEAK     XDPEAK
     4.476E+06 4.766E+02 0.          0.
     0.        0.        0.          0.
 TIME     DXPM        PMAX       XPM     DPMAX       XDPM      TPMAX      XTPM
.1200       3. 4.028E+06      451. 1.535E+07     496. 1.921E+07     499.
          PEAK      XPEAK     DPPEAK     XDPEAK
     3.990E+06 5.015E+[illegible] 0.          0.
     0.        0.        0.          0.
 TIME     DXPM        PMAX       XPM     DPMAX       XDPM      TPMAX      XTPM
.1300       3. 3.644E+06      528. 1.285E+07     522. 1.634E+07     522.
          PEAK      XPEAK     DPPEAK     XDPEAK
     3.370E+06 4.716E+02 0.          0.
     [illegible].415E+05 8.065E+00 0.          0.
 TIME     DXPM        PMAX       XPM     DPMAX       XDPM      TPMAX      XTPM
.1400       3. 3.288E+06      550. 1.081E+07     546. 1.401E+07     546.
          PEAK      XPEAK     DPPEAK     XDPEAK
     2.871E+06 4.904E+02 0.          0.
     1.631E+06 1.178E+02 0.          0.
 TIME     DXPM        PMAX       XPM     DPMAX       XDPM      TPMAX      XTPM
.1500       3. 3.031E+06      573. 9.201E+06     569. 1.216E+07     569.
          PEAK      XPEAK     DPPEAK     XDPEAK
     2.491E+06 5.068E+02 0.          0.
     1.646E+06 1.438E+02 0.          0.
 TIME     DXPM        PMAX       XPM     DPMAX       XDPM      TPMAX      XTPM
.1600       4. 2.782E+06      595. 7.892E+06     591. 1.065E+07     591.
          PEAK      XPEAK     DPPEAK     XDPEAK
     2.204E+06 5.261E+02 0.          0.
     1.637E+06 1.585E+02 0.          0.
 TIME     DXPM        PMAX       XPM     DPMAX       XDPM      TPMAX      XTPM
.1700       4. 2.559E+06      613. 6.813E+06     610. 9.321E+06     613.
          PEAK      XPEAK     DPPEAK     XDPEAK
     1.968E+06 5.442E+02 0.          0.
     2.040E+06 9.803E+00 0.          0.
 TIME     DXPM        PMAX       XPM     DPMAX       XDPM      TPMAX      XTPM
.1800       4. 2.377E+06      635. 5.962E+06     631. 8.335E+06     631.
          PEAK      XPEAK     DPPEAK     XDPEAK
     1.775E+06 5.588E+02 0.          0.
     1.853E+06 6.530E+01 0.          0.
```

AFWL HULL Calculation of 1 MT at 750 Feet HOB - Ideal Surface

```
PROBLEM NUMBER           13.0054
PRESSURE IN PASCALS      DISTANCE IN METERS

 TIME     DXPM        PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
.1900        4.  2.221E+06      652.  5.210E+06      647.  7.383E+06      652.
          PEAK       XPEAK       DPPEAK     XDPEAK
    1.620E+06  5.759E+02  0.             0.
    1.711E+06  1.042E+02  0.             0.
 TIME     DXPM        PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
.2000        4.  2.058E+06      668.  4.599E+06      668.  6.657E+06      668.
          PEAK       XPEAK       DPPEAK     XDPEAK
    1.486E+06  5.927E+02  0.             0.
    1.555E+06  1.324E+02  0.             0.
 TIME     DXPM        PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
.2100        4.  1.931E+06      685.  4.113E+06      685.  6.044E+06      685.
          PEAK       XPEAK       DPPEAK     XDPEAK
    1.371E+06  6.054E+02  0.             0.
    1.402E+06  1.590E+02  0.             0.
 TIME     DXPM        PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
.2300        4.  1.723E+06      719.  3.346E+06      719.  5.069E+06      719.
          PEAK       XPEAK       DPPEAK     XDPEAK
    1.185E+06  6.390E+02  0.             0.
    1.165E+06  2.078E+02  0.             0.
 TIME     DXPM        PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
.2500        5.  1.528E+06      746.  2.748E+06      746.  4.276E+06      746.
          PEAK       XPEAK       DPPEAK     XDPEAK
    1.035E+06  6.674E+02  0.             0.
    9.649E+05  2.654E+02  0.             0.
 TIME     DXPM        PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
.2600        5.  1.452E+06      760.  2.508E+06      760.  3.960E+06      760.
          PEAK       XPEAK       DPPEAK     XDPEAK
    8.887E+05  3.193E+02  0.             0.
    8.252E+05  4.676E+01  0.             0.
 TIME     DXPM        PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
.2800        5.  1.326E+06      788.  2.140E+06      788.  3.466E+06      788.
          PEAK       XPEAK       DPPEAK     XDPEAK
    7.808E+05  3.570E+02  0.             0.
    7.415E+05  9.573E+00  0.             0.
 TIME     DXPM        PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
.3000        5.  1.202E+06      812.  1.836E+06      818.  3.019E+06      818.
          PEAK       XPEAK       DPPEAK     XDPEAK
    6.955E+05  3.936E+02  1.460E+06  7.767E+02
    5.676E+05  9.020E+01  0.             0.
 TIME     DXPM        PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
.3200        5.  1.109E+06      838.  1.601E+06      838.  2.711E+06      838.
          PEAK       XPEAK       DPPEAK     XDPEAK
    6.300E+05  4.305E+02  1.226E+06  7.920E+02
    4.591E+05  7.116E+01  0.             0.
```

AFWL HULL Calculation of 1 MT at 750 Feet HOB - Ideal Surface

```
PROBLEM NUMBER           13.0054
PRESSURE IN PASCALS      DISTANCE IN METERS

 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX     XTPM
.3400       5.  1.024E+06       864. 1.455E+06      864. 2.479E+06      864.
          PEAK      XPEAK     DPPEAK    XDPEAK
     5.893E+05  4.555E+02  1.038E+06 8.124E+02
     3.666E+05  5.155E+01  0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX     XTPM
.3600      13.  9.144E+05       871. 1.161E+06      884. 2.075E+06      884.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.123E+03  1.491E+03  8.741E+05 8.326E+02
     1.123E+03  1.362E+03  1.252E+05 4.970E+02
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX     XTPM
.3800      13.  8.383E+05       897. 1.018E+06      897. 1.857E+06      897.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.123E+03  1.491E+03  1.205E+05 5.357E+02
     1.123E+03  1.362E+03  0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX     XTPM
.4000      13.  7.522E+05       910. 8.766E+05      923. 1.624E+06      923.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.123E+03  1.491E+03  1.175E+05 5.744E+02
     1.123E+03  1.362E+03  0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX     XTPM
.4200      13.  7.209E+05       936. 8.098E+05      936. 1.531E+06      936.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.123E+03  1.491E+03  1.164E+05 6.003E+02
     1.123E+03  1.362E+03  0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX     XTPM
.4500      13.  6.707E+05       962. 7.040E+05      962. 1.375E+06      962.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.123E+03  1.491E+03  1.169E+05 6.519E+02
     1.123E+03  1.362E+03  0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX     XTPM
.4800      13.  6.319E+05       988. 6.455E+05     1000. 1.263E+06      988.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.123E+03  1.491E+03  1.193E+05 7.035E+02
     1.123E+03  1.362E+03  0.        0.
 TIME     DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX     XTPM
.5000      13.  6.083E+05      1013. 6.340E+05     1013. 1.242E+06     1013.
          PEAK      XPEAK     DPPEAK    XDPEAK
     1.123E+03  1.491E+03  1.202E+05 7.293E+02
     1.123E+03  1.362E+03  0.        0.
```

AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Ideal Surface

```
PROBLEM NUMBER          13.0052
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX       XTPM
.0122        2.-1.013E+05         239. 6.801E-06      139. 0.                   0.
           PEAK      XPEAK          DPPEAK     XDPEAK
    0.          0.          0.          0.
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX       XTPM
.0130        2. 1.123E+03         223. 1.792E-01      142. 1.123E+03       223.
           PEAK      XPEAK          DPPEAK     XDPEAK
  -1.817E+03 1.170E+00 0.              0.
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX       XTPM
.0140        2. 1.123E+03         223. 8.374E-01      142. 1.123E+03       223.
           PEAK      XPEAK          DPPEAK     XDPEAK
  -1.814E+03 1.170E+00 0.              0.
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX       XTPM
.0150        2. 1.123E+03         223. 1.640E+00      142. 1.123E+03       223.
           PEAK      XPEAK          DPPEAK     XDPEAK
  -1.811E+03 1.170E+00 0.              0.
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX       XTPM
.0160        2. 1.123E+03         223. 2.250E+00      142. 1.123E+03       223.
           PEAK      XPEAK          DPPEAK     XDPEAK
  -1.809E+03 1.170E+00 0.              0.
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX       XTPM
.0170        2. 1.123E+03         223. 2.565E+00      142. 1.123E+03       223.
           PEAK      XPEAK          DPPEAK     XDPEAK
  -1.808E+03 1.170E+00 0.              0.
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX       XTPM
.0180        2. 1.123E+03         223. 3.002E+00      144. 1.123E+03       223.
           PEAK      XPEAK          DPPEAK     XDPEAK
  -1.678E+03 1.392E+02 0.              0.
  -1.807E+03 1.170E+00 0.              0.
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX       XTPM
.0190        2. 1.123E+03         223. 3.777E+00      144. 1.123E+03       223.
           PEAK      XPEAK          DPPEAK     XDPEAK
  -1.646E+03 1.392E+02 0.              0.
  -1.807E+03 1.170E+00 0.              0.
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX       XTPM
.0200        2. 1.123E+03         223. 4.455E+00      144. 1.123E+03       223.
           PEAK      XPEAK          DPPEAK     XDPEAK
  -1.604E+03 1.392E+02 0.              0.
  -1.807E+03 1.755E+01 0.              0.
```

AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Ideal Surface

```
PROBLEM NUMBER           13.0052
PRESSURE IN PASCALS      DISTANCE IN METERS

 TIME     DXPM       PMAX       XPM    DPMAX      XDPM     TPMAX      XTPM
.0210       2.  1.123E+03      223. 4.939E+00     144. 1.123E+03      223.
          PEAK      XPEAK      DPPEAK    XDPEAK
   -1.558E+03 1.392E+02 0.          0.
   -1.806E+03 1.989E+01 0.          0.
 TIME     DXPM       PMAX       XPM    DPMAX      XDPM     TPMAX      XTPM
.0230       2.  1.123E+03      223. 5.090E+00     144. 1.123E+03      223.
          PEAK      XPEAK      DPPEAK    XDPEAK
   -1.370E+03 1.416E+02 0.          0.
   -1.806E+03 1.989E+01 0.          0.
 TIME     DXPM       PMAX       XPM    DPMAX      XDPM     TPMAX      XTPM
.0250       3.  1.123E+03      224. 6.085E+00     147. 1.123E+03      224.
          PEAK      XPEAK      DPPEAK    XDPEAK
   -1.180E+03 1.410E+02 2.243E+00 1.410E+02
   -1.806E+03 3.121E+01 0.          0.
 TIME     DXPM       PMAX       XPM    DPMAX      XDPM     TPMAX      XTPM
.0260       3.  1.123E+03      224. 6.896E+00     147. 1.123E+03      224.
          PEAK      XPEAK      DPPEAK    XDPEAK
   -1.216E+03 1.410E+02 2.513E+00 1.410E+02
   -1.806E+03 3.121E+01 0.          0.
 TIME     DXPM       PMAX       XPM    DPMAX      XDPM     TPMAX      XTPM
.0280       2.  1.123E+03      209. 6.528E+00     148. 1.123E+03      209.
          PEAK      XPEAK      DPPEAK    XDPEAK
   -1.349E+03 1.435E+02 2.364E+00 1.410E+02
   -1.391E+03 1.397E+02 0.          0.
 TIME     DXPM       PMAX       XPM    DPMAX      XDPM     TPMAX      XTPM
.0300       2.  1.123E+03      209. 7.581E+00     150. 1.123E+03      209.
          PEAK      XPEAK      DPPEAK    XDPEAK
   -1.298E+03 1.435E+02 2.971E+00 1.435E+02
   -1.387E+03 1.397E+02 2.005E+00 1.410E+02
 TIME     DXPM       PMAX       XPM    DPMAX      XDPM     TPMAX      XTPM
.0320       2.  1.123E+03      209. 7.644E+00     151. 1.123E+03      209.
          PEAK      XPEAK      DPPEAK    XDPEAK
   -1.416E+03 1.459E+02 3.180E+00 1.435E+02
   -1.388E+03 1.435E+02 0.          0.
 TIME     DXPM       PMAX       XPM    DPMAX      XDPM     TPMAX      XTPM
.0340       8.  5.623E+07        4. 5.612E+07      12. 1.112E+08        4.
          PEAK      XPEAK      DPPEAK    XDPEAK
      0.          0.        0.          0.
      0.          0.        0.          0.
 TIME     DXPM       PMAX       XPM    DPMAX      XDPM     TPMAX      XTPM
.0360       6.  1.227E+08       51. 5.424E+07      67. 1.329E+08       56.
          PEAK      XPEAK      DPPEAK    XDPEAK
      0.          0.        0.          0.
      0.          0.        0.          0.
```

AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Ideal Surface

```
PROBLEM NUMBER          13.0052
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME     DXPM        PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0380       2.  1.143E+08         82.  5.398E+07        94.  1.355E+08        86.
          PEAK       XPEAK      DPPEAK      XDPEAK
    5.679E+07  5.243E+01  5.513E+06  6.241E+01
    5.455E+07  4.578E+01  0.         0.
 TIME     DXPM        PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0400       2.  1.038E+08        106.  5.139E+07       114.  1.329E+08       108.
          PEAK       XPEAK      DPPEAK      XDPEAK
    5.314E+07  8.534E+01  8.607E+06  9.140E+01
    3.202E+07  5.299E+01  0.         0.
 TIME     DXPM        PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0420       2.  9.317E+07        126.  4.778E+07       132.  1.272E+08       126.
          PEAK       XPEAK      DPPEAK      XDPEAK
    4.943E+07  1.076E+02  1.133E+07  1.116E+02
    3.010E+07  8.331E+01  0.         0.
 TIME     DXPM        PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0450       2.  7.901E+07        148.  4.392E+07       152.  1.167E+08       150.
          PEAK       XPEAK      DPPEAK      XDPEAK
    4.453E+07  1.339E+02  1.526E+07  1.359E+02
    2.817E+07  1.177E+02  0.         0.
 TIME     DXPM        PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0480       2.  6.595E+07        169.  3.999E+07       169.  1.059E+08       169.
          PEAK       XPEAK      DPPEAK      XDPEAK
    3.955E+07  1.570E+02  0.         0.
    0.         0.         0.         0.
 TIME     DXPM        PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0500       2.  6.031E+07        180.  3.997E+07       180.  1.003E+08       180.
          PEAK       XPEAK      DPPEAK      XDPEAK
    3.702E+07  1.687E+02  1.935E+07  1.710E+02
    0.         0.         0.         0.
 TIME     DXPM        PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0530       3.  5.098E+07        196.  3.849E+07       196.  8.947E+07       196.
          PEAK       XPEAK      DPPEAK      XDPEAK
    0.         0.         0.         0.
    0.         0.         0.         0.
 TIME     DXPM        PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0560       3.  4.422E+07        212.  3.848E+07       212.  8.270E+07       212.
          PEAK       XPEAK      DPPEAK      XDPEAK
    4.741E+06  3.105E+00  0.         0.
    0.         0.         0.         0.
 TIME     DXPM        PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0600       3.  3.688E+07        230.  3.826E+07       230.  7.514E+07       230.
          PEAK       XPEAK      DPPEAK      XDPEAK
    3.626E+06  3.105E+00  0.         0.
    0.         0.         0.         0.
```

# AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Ideal Surface

```
PROBLEM NUMBER          13.0052
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME    DXPM        PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.0650      3. 2.983E+07      247. 3.582E+07      250. 6.510E+07      247.
         PEAK      XPEAK      DPPEAK     XDPEAK
    0.          0.         0.          0.
    0.          0.         0.          0.
 TIME    DXPM        PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.0700      3. 2.597E+07      267. 3.947E+07      267. 6.545E+07      267.
         PEAK      XPEAK      DPPEAK     XDPEAK
    0.          0.         0.          0.
    0.          0.         0.          0.
 TIME    DXPM        PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.0750      3. 2.304E+07      2[illegible]. 4.183E+07      284. 6.392E+07      284.
         PEAK      XPEAK      DPPEAK     XDPEAK
    0.          0.         0.          0.
    0.          0.         0.          0.
 TIME    DXPM        PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.0800      3. 1.961E+07      296. 4.219E+07      299. 6.133E+07      299.
         PEAK      XPEAK      DPPEAK     XDPEAK
    0.          0.         0.          0.
    0.          0.         0.          0.
 TIME    DXPM        PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.0850      3. 1.721E+07      311. 4.199E+07      314. 5.828E+07      314.
         PEAK      XPEAK      DPPEAK     XDPEAK
    0.          0.         0.          0.
    0.          0.         0.          0.
 TIME    DXPM        PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.0900      3. 1.484E+07      323. 4.017E+07      329. 5.321E+07      329.
         PEAK      XPEAK      DPPEAK     XDPEAK
    0.          0.         0.          0.
    0.          0.         0.          0.
 TIME    DXPM        PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.0950      3. 1.303E+07      338. 3.725E+07      341. 4.921E+07      341.
         PEAK      XPEAK      DPPEAK     XDPEAK
    0.          0.         0.          0.
    0.          0.         0.          0.
 TIME    DXPM        PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.1000      3. 1.159E+07      350. 3.414E+07      356. 4.488E+07      353.
         PEAK      XPEAK      DPPEAK     XDPEAK
    0.          0.         0.          0.
    0.          0.         0.          0.
 TIME    DXPM        PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.1100      3. 9.413E+06      371. 2.873E+07      380. 3.694E+07      377.
         PEAK      XPEAK      DPPEAK     XDPEAK
    0.          0.         0.          0.
    0.          0.         0.          0.
```

AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Ideal Surface

```
PROBLEM NUMBER          13.0052
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME      DXPM        PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.1200        3.  7.804E+06      392.  2.388E+07     402.  3.049E+07     399.
           PEAK      XPEAK       DPPEAK     XDPEAK
    0.           0.          0.          0.
    0.           0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.1300        3.  6.722E+06      410.  2.039E+07     423.  2.596E+07     420.
           PEAK      XPEAK       DPPEAK     XDPEAK
    0.           0.          0.          0.
    0.           0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.1400        3.  6.002E+06      430.  1.788E+07     443.  2.281E+07     440.
           PEAK      XPEAK       DPPEAK     XDPEAK
    0.           0.          0.          0.
    0.           0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.1500        3.  5.380E+06      446.  1.614E+07     463.  2.055E+07     460.
           PEAK      XPEAK       DPPEAK     XDPEAK
    0.           0.          0.          0.
    0.           0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.1600        3.  4.751E+06      469.  1.449E+07     486.  1.836E+07     479.
           PEAK      XPEAK       DPPEAK     XDPEAK
    2.592E+06 5.101E+02  0.          0.
    0.           0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.1700        3.  4.167E+06      486.  1.[illegible]96E+07     507.  1.635E+07     500.
           PEAK      XPEAK       DPPEAK     XDPEAK
    2.480E+06 5.308E+02  0.          0.
    0.           0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.1800        4.  3.635E+06      502.  1.154E+07     528.  1.446E+07     520.
           PEAK      XPEAK       DPPEAK     XDPEAK
    2.349E+06 5.530E+02  0.          0.
    0.           0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.1900        4.  3.192E+06      520.  1.030E+07     546.  1.280E+07     538.
           PEAK      XPEAK       DPPEAK     XDPEAK
    2.246E+06 5.748E+[illegible]  0.          0.
    0.           0.          [illegible]          0.
 TIME      DXPM        PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.2000        4.  2.818E+06      535.  9.229E+06     571.  1.139E+07     560.
           PEAK      XPEAK       DPPEAK     XDPEAK
    2.161E+06 5.929E+02  0.          0.
    0.           0.          0.          0.
```

AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Ideal Surface

```
PROBLEM NUMBER          13.0052
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME      DXPM        PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.2100        4.  2.509E+06       552.  8.387E+06     596.  1.027E+07      600.
             PEAK      XPEAK     DPPEAK     XDPEAK
     2.036E+06 6.120E+02 0.                0.
     0.        0.        0.                0.
 TIME      DXPM        PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.2300        4.  2.032E+06       584.  6.948E+06     638.  8.648E+06      638.
             PEAK      XPEAK     DPPEAK     XDPEAK
     1.814E+06 6.468E+02 0.                0.
     0.        0.        0.                0.
 TIME      DXPM        PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.2500        4.  1.682E+06       613.  5.833E+06     672.  7.388E+06      676.
             PEAK      XPEAK     DPPEAK     XDPEAK
     1.[illegible]67E+06 6.847E+02 0.                0.
     6.271E+05 2.505E+01 0.                0.
 TIME      DXPM        PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.2600        4.  1.596E+06       701.  5.375E+06     689.  6.871E+06      693.
             PEAK      XPEAK     DPPEAK     XDPEAK
     1.549E+06 6.258E+02 0.                0.
     7.305E+05 8.430E+00 0.                0.
 TIME      DXPM        PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.2800        5.  1.449E+06       732.  4.560E+06     718.  5.921E+06      723.
             PEAK      XPEAK     DPPEAK     XDPEAK
     1.330E+06 6.535E+02 0.                0.
     8.309E+05 9.573E+00 0.                0.
 TIME      DXPM        PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.3000        5.  1.326E+06       760.  3.901E+06     751.  5.165E+06      755.
             PEAK      XPEAK     DPPEAK     XDPEAK
     1.164E+06 6.813E+02 0.                0.
     8.255E+05 9.573E+00 0.                0.
 TIME      DXPM        PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.3200        5.  1.237E+06       792.  3.366E+06     782.  4.542E+06      787.
             PEAK      XPEAK     DPPEAK     XDPEAK
     1.033E+06 7.052E+02 0.                0.
     7.638E+05 1.055E+01 0.                0.
 TIME      DXPM        PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.3400        5.  1.141E+06       818.  2.922E+06     807.  4.016E+06      812.
             PEAK      XPEAK     DPPEAK     XDPEAK
     9.198E+05 7.256E+02 0.                0.
     6.590E+05 1.087E+02 0.                0.
 TIME      DXPM        PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.3600        5.  1.066E+06       843.  2.551E+06     833.  3.578E+06      838.
             PEAK      XPEAK     DPPEAK     XDPEAK
     8.311E+05 7.511E+02 0.                0.
     5.971E+05 1.610E+02 0.                0.
```

AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Ideal Surface

```
PROBLEM NUMBER              13.0052
PRESSURE IN PASCALS         DISTANCE IN METERS

  TIME     DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX        XTPM
 .3800       5.  1.004E+06        869.  2.244E+06       864.  3.218E+06        864.
            PEAK        XPEAK      DPPEAK      XDPEAK
     7.579E+05  7.716E+02  0.              0.
     5.555E+05  1.933E+02  0.              0.
  TIME     DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX        XTPM
 .4000       6.  9.312E+05        890.  1.984E+06       884.  2.906E+06        890.
            PEAK        XPEAK      DPPEAK      XDPEAK
     6.932E+05  7.943E+02  0.              0.
     5.203E+05  2.302E+02  0.              0.
  TIME     DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX        XTPM
 .4200       6.  8.749E+05        918.  1.762E+06       913.  2.635E+06        913.
            PEAK        XPEAK      DPPEAK      XDPEAK
     1.123E+03  1.003E+03  0.              0.
     1.123E+03  9.915E+02  0.              0.
  TIME     DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX        XTPM
 .4500       6.  8.113E+05        946.  1.498E+06       946.  2.309E+06        946.
            PEAK        XPEAK      DPPEAK      XDPEAK
     5.708E+05  8.450E+02  1.472E+06  9.126E+02
     4.448E+05  2.936E+02  0.              0.
  TIME     DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX        XTPM
 .4800       7.  7.455E+05        977.  1.275E+06       977.  2.020E+06        977.
            PEAK        XPEAK      DPPEAK      XDPEAK
     1.123E+03  1.114E+03  1.261E+06  9.382E+02
     1.123E+03  1.101E+03  0.              0.
  TIME     DXPM        PMAX        XPM      DPMAX       XDPM       TPMAX        XTPM
 .5000       7.  7.037E+05        997.  1.160E+06       997.  1.863E+06        997.
            PEAK        XPEAK      DPPEAK      XDPEAK
     1.123E+03  1.114E+03  1.143E+06  9.513E+02
     1.123E+03  1.101E+03  0.              0.
```

# APPENDIX B

## AFWL HULL CALCULATION OF 1 MT, PRECURSED CASE

AFWL HULL Calculation of 1 MT Surface Burst Precursed Case

```
PROBLEM NUMBER          13.0041
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME    DXPM       PMAX      XPM     DPMAX     XDPM      TPMAX     XTPM
.0383       2.-1.013E+05     469. 4.206E+07     363. 4.196E+07     363.
         PEAK     XPEAK      DPPEAK    XDPEAK
    0.        0.        0.        0.
    0.        0.        0.        0.
 TIME    DXPM       PMAX      XPM     DPMAX     XDPM      TPMAX     XTPM
.0400       2. 9.772E+06     367. 3.314E+07     367. 4.291E+07     367.
         PEAK     XPEAK      DPPEAK    XDPEAK
    4.928E+06 2.797E+02 0.            0.
    5.299E+06 1.988E+02 0.            0.
 TIME    DXPM       PMAX      XPM     DPMAX     XDPM      TPMAX     XTPM
.0420       2. 8.523E+06     375. 3.024E+07     375. 3.877E+07     375.
         PEAK     XPEAK      DPPEAK    XDPEAK
    5.688E+06 1.453E+02 0.            0.
    5.176E+06 1.033E+02 0.            0.
 TIME    DXPM       PMAX      XPM     DPMAX     XDPM      TPMAX     XTPM
.0450       2. 9.315E+06     387. 2.805E+07     385. 3.721E+07     385.
         PEAK     XPEAK      DPPEAK    XDPEAK
    5.074E+06 1.183E+02 0.            0.
    0.        0.        0.        0.
 TIME    DXPM       PMAX      XPM     DPMAX     XDPM      TPMAX     XTPM
.0480       2. 9.232E+06     395. 2.592E+07     395. 3.515E+07     395.
         PEAK     XPEAK      DPPEAK    XDPEAK
    4.170E+06 2.231E+02 0.            0.
    5.251E+06 1.094E+01 0.            0.
 TIME    DXPM       PMAX      XPM     DPMAX     XDPM      TPMAX     XTPM
.0500       2. 8.843E+06     401. 2.464E+07     401. 3.348E+07     401.
         PEAK     XPEAK      DPPEAK    XDPEAK
    4.013E+06 2.541E+02 0.            0.
    5.066E+06 1.094E+01 0.            0.
 TIME    DXPM       PMAX      XPM     DPMAX     XDPM      TPMAX     XTPM
.0530       2. 8.256E+06     411. 2.383E+07     411. 3.209E+07     411.
         PEAK     XPEAK      DPPEAK    XDPEAK
    3.790E+06 2.989E+02 0.            0.
    0.        0.        0.        0.
 TIME    DXPM       PMAX      XPM     DPMAX     XDPM      TPMAX     XTPM
.0560       2. 7.754E+06     419. 2.291E+07     421. 3.039E+07     421.
         PEAK     XPEAK      DPPEAK    XDPEAK
    3.576E+06 3.590E+02 0.            0.
    3.568E+06 3.550E+02 0.            0.
 TIME    DXPM       PMAX      XPM     DPMAX     XDPM      TPMAX     XTPM
.0600       2. 7.116E+06     429. 2.168E+07     433. 2.860E+07     431.
         PEAK     XPEAK      DPPEAK    XDPEAK
    3.354E+06 3.510E+02 0.            0.
    3.245E+06 1.094E+01 0.            0.
```

AFWL HULL Calculation of 1 MT Surface Burst Precursed Case

```
PROBLEM NUMBER            13.0041
PRESSURE IN PASCALS       DISTANCE IN METERS

 TIME     DXPM       PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0650       2.  6.496E+06       443.  2.025E+07       447.  2.652E+07       445.
          PEAK      XPEAK       DPPEAK      XDPEAK
     2.974E+06  3.770E+02  0.              0.
     2.930E+06  3.470E+02  0.              0.
 TIME     DXPM       PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0700       2.  5.830E+06       454.  1.837E+07       459.  2.385E+07       459.
          PEAK      XPEAK       DPPEAK      XDPEAK
     2.726E+06  1.981E+02  0.              0.
     2.782E+06  1.709E+02  0.              0.
 TIME     DXPM       PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0750       2.  5.306E+06       466.  1.649E+07       471.  2.158E+07       471.
          PEAK      XPEAK       DPPEAK      XDPEAK
     2.409E+06  2.368E+02  0.              0.
     2.408E+06  2.222E+02  0.              0.
 TIME     DXPM       PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0800       2.  4.882E+06       478.  1.511E+07       485.  1.957E+07       482.
          PEAK      XPEAK       DPPEAK      XDPEAK
     2.178E+06  3.512E+02  0.              0.
     2.094E+06  2.064E+02  0.              0.
 TIME     DXPM       PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0850       2.  4.519E+06       489.  1.377E+07       497.  1.783E+07       494.
          PEAK      XPEAK       DPPEAK      XDPEAK
     2.167E+06  3.865E+02  0.              0.
     1.863E+06  1.803E+02  0.              0.
 TIME     DXPM       PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0900       3.  4.169E+06       500.  1.242E+07       507.  1.619E+07       507.
          PEAK      XPEAK       DPPEAK      XDPEAK
     2.114E+06  4.093E+02  0.              0.
     1.645E+06  8.694E+01  0.              0.
 TIME     DXPM       PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.0950       3.  3.877E+06       510.  1.134E+07       520.  1.489E+07       518.
          PEAK      XPEAK       DPPEAK      XDPEAK
     2.032E+06  4.325E+02  0.              0.
     1.632E+06  1.038E+02  0.              0.
 TIME     DXPM       PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.1000       3.  3.634E+06       520.  1.048E+07       531.  1.375E+07       528.
          PEAK      XPEAK       DPPEAK      XDPEAK
     1.960E+06  4.506E+02  0.              0.
     1.635E+06  2.625E+02  0.              0.
 TIME     DXPM       PMAX        XPM      DPMAX       XDPM      TPMAX       XTPM
.1100       3.  3.233E+06       541.  9.010E+06       551.  1.187E+07       549.
          PEAK      XPEAK       DPPEAK      XDPEAK
     1.466E+06  3.741E+02  0.              0.
     1.491E+06  2.791E+02  0.              0.
```

AFWL HULL Calculation of 1 MT Surface Burst Precursed Case

```
PROBLEM NUMBER          13.0041
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME     DXPM        PMAX      XPM     DPMAX       XDPM      TPMAX      XTPM
.1200       3. 2.898E+06      558. 7.775E+06      572. 1.034E+07      569.
          PEAK      XPEAK       DPPEAK     XDPEAK
     1.339E+06 4.385E+02 0.             0.
     1.356E+06 3.584E+02 0.             0.
 TIME     DXPM        PMAX      XPM     DPMAX       XDPM      TPMAX      XTPM
.1300       3. 2.619E+06      575. 6.905E+06      589. 9.215E+06      589.
          PEAK      XPEAK       DPPEAK     XDPEAK
     1.243E+06 4.499E+02 0.             0.
     1.248E+06 4.299E+02 0.             0.
 TIME     DXPM        PMAX      XPM     DPMAX       XDPM      TPMAX      XTPM
.1400       3. 2.387E+06      592. 6.152E+06      608. 8.230E+06      605.
          PEAK      XPEAK       DPPEAK     XDPEAK
     1.170E+06 4.767E+02 0.             0.
     1.166E+06 4.602E+02 0.             0.
 TIME     DXPM        PMAX      XPM     DPMAX       XDPM      TPMAX      XTPM
.1500       3. 2.181E+06      608. 5.485E+06      628. 7.372E+06      625.
          PEAK      XPEAK       DPPEAK     XDPEAK
     1.105E+06 5.096E+02 0.             0.
     1.061E+06 4.214E+02 0.             0.
 TIME     DXPM        PMAX      XPM     DPMAX       XDPM      TPMAX      XTPM
.1600       3. 2.004E+06      625. 4.988E+06      645. 6.713E+06      641.
          PEAK      XPEAK       DPPEAK     XDPEAK
     9.961E+05 4.734E+02 0.             0.
     9.946E+05 4.602E+02 0.             0.
 TIME     DXPM        PMAX      XPM     DPMAX       XDPM      TPMAX      XTPM
.1700       3. 1.854E+06      641. 4.546E+06      661. 6.124E+06      658.
          PEAK      XPEAK       DPPEAK     XDPEAK
     9.446E+05 5.030E+02 0.             0.
     9.408E+05 4.833E+02 0.             0.
 TIME     DXPM        PMAX      XPM     DPMAX       XDPM      TPMAX      XTPM
.1800       4. 1.717E+06      657. 4.115E+06      677. 5.575E+06      673.
          PEAK      XPEAK       DPPEAK     XDPEAK
     8.639E+05 4.274E+02 0.             0.
     8.621E+05 3.533E+02 0.             0.
 TIME     DXPM        PMAX      XPM     DPMAX       XDPM      TPMAX      XTPM
.1900       4. 1.598E+06      669. 3.775E+06      693. 5.115E+06      685.
          PEAK      XPEAK       DPPEAK     XDPEAK
     8.121E+05 4.490E+02 0.             0.
     8.101E+05 4.216E+02 0.             0.
 TIME     DXPM        PMAX      XPM     DPMAX       XDPM      TPMAX      XTPM
.2000       4. 1.492E+06      685. 3.508E+06      709. 4.767E+06      701.
          PEAK      XPEAK       DPPEAK     XDPEAK
     7.647E+05 4.385E+02 0.             0.
     7.648E+05 4.274E+02 0.             0.
```

AFWL HULL Calculation of 1 MT Surface Burst Precursed Case

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PROBLEM NUMBER              13.0041
PRESSURE IN PASCALS         DISTANCE IN METERS

 TIME     DXPM       PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
 .2100       5.  1.401E+06     696.  3.246E+06       724.  4.423E+06       715.
          PEAK      XPEAK      DPPEAK     XDPEAK
     7.328E+05  5.108E+02  0.             0.
     7.230E+05  4.601E+02  0.             0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
 .2300       5.  1.245E+06     724.  2.804E+06       747.  3.840E+06       743.
          PEAK      XPEAK      DPPEAK     XDPEAK
     6.552E+05  5.203E+02  0.             0.
     6.514E+05  5.108E+02  0.             0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
 .2500       5.  1.119E+06     747.  2.489E+06       775.  3.410E+06       766.
          PEAK      XPEAK      DPPEAK     XDPEAK
     5.926E+05  5.296E+02  0.             0.
     5.919E+05  5.203E+02  0.             0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
 .2600       5.  1.065E+06     757.  2.350E+06       789.  3.226E+06       780.
          PEAK      XPEAK      DPPEAK     XDPEAK
     5.651E+05  5.389E+02  0.             0.
     5.645E+05  5.296E+02  0.             0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
 .2720       6.  1.002E+06     771.  2.195E+06       805.  3.011E+06       794.
          PEAK      XPEAK      DPPEAK     XDPEAK
     5.589E+05  6.077E+02  0.             0.
     5.398E+05  5.387E+02  0.             0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
 .2800       6.  9.692E+05     782.  2.095E+06       810.  2.876E+06       805.
          PEAK      XPEAK      DPPEAK     XDPEAK
     5.124E+05  5.323E+02  0.             0.
     5.163E+05  5.188E+02  0.             0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
 .2931       6.  9.186E+05     794.  1.937E+06       827.  2.683E+06       816.
          PEAK      XPEAK      DPPEAK     XDPEAK
     6.112E+05  8.499E+02  0.             0.
     4.900E+05  5.549E+02  0.             0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
 .3000       6.  8.913E+05     799.  1.887E+06       833.  2.599E+06       822.
          PEAK      XPEAK      DPPEAK     XDPEAK
     6.038E+05  8.555E+02  0.             0.
     4.772E+05  5.795E+02  0.             0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM      TPMAX       XTPM
 .3200       6.  8.266E+05     822.  1.767E+06       856.  2.426E+06       850.
          PEAK      XPEAK      DPPEAK     XDPEAK
     4.355E+05  5.675E+02  0.             0.
     4.326E+05  5.482E+02  0.             0.
```

AFWL HULL Calculation of 1 MT Surface Burst Precursed Case

PROBLEM NUMBER 13.0041
PRESSURE IN PASCALS DISTANCE IN METERS

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .3373 | 6. | 7.818E+05 | 839. | 1.647E+06 | 872. | 2.269E+06 | 667. |

| PEAK | XPEAK | DPPEAK | XDPEAK |
|---|---|---|---|
| 5.092E+05 | 9.006E+02 | 0. | 0. |
| 4.078E+05 | 5.736E+02 | 0. | 0. |

AFWL HULL Calculation of 1 MT at 500 Feet Precursed Case

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PROBLEM NUMBER            13.0048
PRESSURE IN PASCALS       DISTANCE IN METERS


  TIME      DXPM        PMAX        XPM       DPMAX       XDPM       TPMAX       XTPM
 .0042         2.-1.013E+05       239. 5.[illegible]7E-04       1. 0.                    0.
            PEAK      XPEAK       DPPEAK     XDPEAK
    0.            0.          8.312E-05 9.335E-05
    0.            0.          8.926E-05 9.736E-05
  TIME      DXPM        PMAX        XPM       DPMAX       XDPM       TPMAX       XTPM
 .0042         2. 1.123E+03       239. 1.478E-04      21. 1.123E+03         239.
            PEAK      XPEAK       DPPEAK     XDPEAK
    1.122E+03 2.170E+02 1.549E-05 3.484E-05
    0.            0.          3.320E-05 3.531E-05
  TIME      DXPM        PMAX        XPM       DPMAX       XDPM       TPMAX       XTPM
 .0045         2. 1.123E+03       239. 8.820E-05      21. 1.123E+03         239.
            PEAK      XPEAK       DPPEAK     XDPEAK
    1.122E+03 2.210E+02 1.060E-05 2.650E-05
    0.            0.          2.519E-05 2.687E-05
  TIME      DXPM        PMAX        XPM       DPMAX       XDPM       TPMAX       XTPM
 .0048         2. 1.123E+03       239. 5.259E-05      69. 1.123E+03         239.
            PEAK      XPEAK       DPPEAK     XDPEAK
    1.122E+03 2.230E+02 5.461E-06 1.946E-05
    0.            0.          7.906E-06 2.041E-05
  TIME      DXPM        PMAX        XPM       DPMAX       XDPM       TPMAX       XTPM
 .0050         2. 1.123E+03       239. 5.114E-05      71. 1.123E+03         239.
            PEAK      XPEAK       DPPEAK     XDPEAK
    1.122E+03 2.250E+02 8.090E-06 8.107E-06
    0.            0.          8.873E-06 7.291E-06
  TIME      DXPM        PMAX        XPM       DPMAX       XDPM       TPMAX       XTPM
 .0053         2. 3.074E+06         3. 7.970E+06       3. 1.104E+07           3.
            PEAK      XPEAK       DPPEAK     XDPEAK
    3.720E+05 1.100E+01 0.          0.
    0.            0.          0.          0.
  TIME      DXPM        PMAX        XPM       DPMAX       XDPM       TPMAX       XTPM
 .0056         2. 3.927E+08         1. 5.942E+08       7. 9.735E+08           1.
            PEAK      XPEAK       DPPEAK     XDPEAK
    0.            0.          5.809E+08 1.000E+00
    0.            0.          0.          0.
  TIME      DXPM        PMAX        XPM       DPMAX       XDPM       TPMAX       XTPM
 .0060         2. 1.009E+09         7. 5.745E+08      35. 1.085E+09          27.
            PEAK      XPEAK       DPPEAK     XDPEAK
    9.969E+08 1.300E+01 0.          0.
    0.            0.          0.          0.
  TIME      DXPM        PMAX        XPM       DPMAX       XDPM       TPMAX       XTPM
 .0065         2. 1.018E+09        41. 5.984E+08      51. 1.219E+09          43.
            PEAK      XPEAK       DPPEAK     XDPEAK
    4.500E+08 1.100E+01 0.          0.
    4.484E+08 3.000E+00 0.          0.
```

AFWL HULL Calculation of 1 MT at 500 Feet Precursed Case

```
PROBLEM NUMBER            13.0048
PRESSURE IN PASCALS       DISTANCE IN METERS

  TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
 .0070        2. 1.005E+09       57. 6.306E+08       65. 1.354E+09       59.
            PEAK      XPEAK       DPPEAK     XDPEAK
     1.746E+08 1.000E+00 0.          0.
      0.        0.        0.          0.
  TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
 .0075        2. 9.117E+08       69. 6.437E+08       75. 1.390E+09       71.
            PEAK      XPEAK       DPPEAK     XDPEAK
     1.004E+08 1.000E+00 0.          0.
      0.        0.        0.          0.
  TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
 .0080        2. 8.123E+08       81. 6.310E+08       85. 1.339E+09       81.
            PEAK      XPEAK       DPPEAK     XDPEAK
      0.        0.        0.          0.
      0.        0.        0.          0.
  TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
 .0085        2. 7.050E+08       91. 6.075E+08       93. 1.275E+09       91.
            PEAK      XPEAK       DPPEAK     XDPEAK
      0.        0.        0.          0.
      0.        0.        0.          0.
  TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
 .0090        2. 5.903E+08       99. 6.009E+08      101. 1.178E+09      101.
            PEAK      XPEAK       DPPEAK     XDPEAK
      0.        0.        0.          0.
      0.        0.        0.          0.
  TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
 .0094        2. 5.338E+08      107. 5.933E+08      107. 1.127E+09      107.
            PEAK      XPEAK       DPPEAK     XDPEAK
      0.        0.        0.          0.
      0.        0.        0.          0.
  TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
 .0095        2. 5.131E+08      107. 5.865E+08      109. 1.080E+09      109.
            PEAK      XPEAK       DPPEAK     XDPEAK
      0.        0.        0.          0.
      0.        0.        0.          0.
  TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
 .0100        2. 4.528E+08      115. 5.632E+08      115. 1.016E+09      115.
            PEAK      XPEAK       DPPEAK     XDPEAK
      0.        0.        0.          0.
      0.        0.        0.          0.
  TIME      DXPM        PMAX       XPM      DPMAX      XDPM      TPMAX      XTPM
 .0110        2. 3.271E+08      127. 5.053E+08      129. 8.199E+08      127.
            PEAK      XPEAK       DPPEAK     XDPEAK
      0.        0.        0.          0.
      0.        0.        0.          0.
```

AFWL HULL Calculation of 1 MT at 500 Feet Precursed Case

PROBLEM NUMBER 13.0048
PRESSURE IN PASCALS DISTANCE IN METERS

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .0120 | 2. | 2.560E+08 | 139. | 5.005E+08 | 139. | 7.565E+08 | 139. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0130 | 2. | 2.151E+08 | 147. | 4.878E+08 | 149. | 6.919E+08 | 149. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0140 | 2. | 1.756E+08 | 157. | 4.48[illegible]E+08 | 157. | 6.240E+08 | 157. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | . | 0. | 0. | [illegible] | | | |
| | . | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0150 | 2. | 1.452E+08 | 165. | 4.118E+08 | 167. | 5.459E+08 | 165. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0160 | 1. | 1.262E+08 | 172. | 3.886E+08 | 175. | 4.987E+08 | 175. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0170 | 1. | 1.108E+08 | 179. | 3.560E+08 | 182. | 4.529E+08 | 182. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0180 | 1. | 9.681E+07 | 186. | 3.200E+08 | 189. | 4.022E+08 | 188. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0190 | 2. | 8.576E+07 | 192. | 2.861E+08 | 195. | 3.615E+08 | 195. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0196 | 2. | 8.009E+07 | 195. | 2.696E+08 | 200. | 3.367E+08 | 198. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |

AFWL HULL Calculation of 1 MT at 500 Feet Precursed Case

```
PROBLEM NUMBER           13.0048
PRESSURE IN PASCALS      DISTANCE IN METERS

 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.0200       2.  7.675E+07      198.  2.588E+08     203.  3.255E+08      201.
          PEAK      XPEAK       DPPEAK    XDPEAK
   0.          0.         0.         0.
   0.          0.         0.         0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.0210       2.  6.930E+07      204.  2.375E+08     209.  2.971E+08      207.
          PEAK      XPEAK       DPPEAK    XDPEAK
   0.          0.         0.         0.
   0.          0.         0.         0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.0230       2.  5.631E+07      216.  1.977E+08     221.  2.456E+08      219.
          PEAK      XPEAK       DPPEAK    XDPEAK
   0.          0.         0.         0.
   0.          0.         0.         0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.0250       2.  4.601E+07      227.  1.644E+08     232.  2.028E+08      230.
          PEAK      XPEAK       DPPEAK    XDPEAK
   1.210E+07 2.524E+02 1.031E+08 2.508E+02
   0.          0.         0.         0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.0260       2.  4.203E+07      232.  1.503E+08     238.  1.858E+08      237.
          PEAK      XPEAK       DPPEAK    XDPEAK
   1.172E+07 2.603E+02 9.862E+07 2.571E+02
   0.          0.         0.         0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.0280       2.  3.521E+07      242.  1.264E+08     249.  1.558E+08      247.
          PEAK      XPEAK       DPPEAK    XDPEAK
   1.101E+07 2.736E+02 9.033E+07 2.719E+02
   0.          0.         0.         0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.0300       2.  2.969E+07      252.  1.068E+08     259.  1.313E+08      257.
          PEAK      XPEAK       DPPEAK    XDPEAK
   1.055E+07 2.869E+02 8.358E+07 2.852E+02
   0.          0.         0.         0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.0320       2.  2.515E+07      259.  8.999E+07     269.  1.105E+08      267.
          PEAK      XPEAK       DPPEAK    XDPEAK
   9.948E+06 2.998E+02 7.645E+07 2.980E+02
   0.          0.         0.         0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX       XTPM
.0340       2.  2.159E+07      269.  7.672E+07     280.  9.426E+07      278.
          PEAK      XPEAK       DPPEAK    XDPEAK
   9.643E+06 3.127E+02 7.092E+07 3.108E+02
   0.          0.         0.         0.
```

# AFWL HULL Calculation of 1 MT at 500 Feet Precursed Case

PROBLEM NUMBER 13.0048
PRESSURE IN PASCALS DISTANCE IN METERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0360 | 2. | 1.869E+07 | 278. | 6.563E+07 | 322. | 8.062E+07 | 286. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 9.233E+06 | 3.245E+02 | 6.553E+07 | 2.881E+02 | | | |
| 0. | | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0380 | 2. | 1.635E+07 | 286. | 6.021E+07 | 333. | 6.930E+07 | 296. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 8.790E+06 | 3.366E+02 | 5.633E+07 | 2.982E+02 | | | |
| 0. | | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0400 | 2. | 1.446E+07 | 292. | 5.617E+07 | 345. | 6.447E+07 | 345. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 8.483E+06 | 3.467E+02 | 4.894E+07 | 3.063E+02 | | | |
| 0. | | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0420 | 2. | 1.287E+07 | 300. | 5.177E+07 | 356. | 5.981E+07 | 356. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 8.106E+06 | 3.581E+02 | 4.274E+07 | 3.160E+02 | | | |
| | 1.253E+06 | 5.801E+01 | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0450 | 2. | 1.096E+07 | 311. | 4.546E+07 | 370. | 5.291E+07 | 372. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 7.519E+06 | 3.745E+02 | 3.519E+07 | 3.277E+02 | | | |
| | 1.722E+06 | 8.126E+01 | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0480 | 2. | 9.450E+06 | 321. | 4.105E+07 | 386. | 4.809E+07 | 386. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 7.173E+06 | 3.886E+02 | 2.949E+07 | 3.394E+02 | | | |
| | 1.841E+06 | 9.565E+01 | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0500 | 2. | 8.625E+06 | 328. | 3.818E+07 | 396. | 4.496E+07 | 396. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 6.929E+06 | 3.979E+02 | 2.640E+07 | 3.464E+02 | | | |
| | 1.693E+06 | 1.025E+02 | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0530 | 3. | 7.545E+06 | 336. | 3.378E+07 | 409. | 4.009E+07 | 409. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 6.384E+06 | 4.115E+02 | 2.241E+07 | 3.574E+02 | | | |
| | 4.223E+06 | 8.287E+01 | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0560 | 3. | 6.670E+06 | 344. | 3.030E+07 | 422. | 3.625E+07 | 422. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 6.097E+06 | 4.251E+02 | 1.924E+07 | 3.682E+02 | | | |
| | 1.312E+06 | 1.868E+02 | 0. | 0. | | | |

AFWL HULL Calculation of 1 MT at 500 Feet Precursed Case

```
PROBLEM NUMBER          13.0048
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME     DXPM       PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.0600       3.  5.773E+06      355. 2.654E+07      439. 3.220E+07      441.
          PEAK      XPEAK     DPPEAK    XDPEAK
     5.718E+06 4.413E+02 1.607E+07 3.844E+02
     1.267E+06 2.026E+02 0.        0.
 TIME     DXPM       PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.0650       3.  5.311E+06      463. 2.259E+07      460. 2.781E+07      460.
          PEAK      XPEAK     DPPEAK    XDPEAK
     4.931E+06 3.701E+02 1.309E+07 4.000E+02
     4.081E+06 1.353E+02 0.        0.
 TIME     DXPM       PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.0700       3.  4.914E+06      481. 1.919E+07      478. 2.401E+07      481.
          PEAK      XPEAK     DPPEAK    XDPEAK
     4.282E+06 3.820E+02 1.084E+07 4.149E+02
     4.008E+06 1.512E+02 0.        0.
 TIME     DXPM       PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.0750       3.  4.605E+06      499. 1.663E+07      496. 2.116E+07      499.
          PEAK      XPEAK     DPPEAK    XDPEAK
     3.775E+06 3.940E+02 9.208E+06 4.298E+02
     1.500E+06 2.673E+02 0.        0.
 TIME     DXPM       PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.0800       3.  4.215E+06      515. 1.427E+07      512. 1.843E+07      512.
          PEAK      XPEAK     DPPEAK    XDPEAK
     3.389E+06 4.045E+02 7.984E+06 4.426E+02
     3.507E+06 1.891E+02 0.        0.
 TIME     DXPM       PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.0850       3.  3.928E+06      529. 1.249E+07      529. 1.642E+07      529.
          PEAK      XPEAK     DPPEAK    XDPEAK
     3.087E+06 4.149E+02 7.002E+06 4.564E+02
     3.195E+06 2.040E+02 0.        0.
 TIME     DXPM       PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.0900       3.  3.740E+06      546. 1.095E+07      546. 1.469E+07      546.
          PEAK      XPEAK     DPPEAK    XDPEAK
     2.832E+06 4.253E+02 0.        0.
     2.919E+06 2.180E+02 0.        0.
 TIME     DXPM       PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.0950       4.  3.483E+06      558. 9.624E+06      558. 1.311E+07      558.
          PEAK      XPEAK     DPPEAK    XDPEAK
     2.606E+06 4.343E+02 0.        0.
     2.695E+06 2.353E+02 0.        0.
 TIME     DXPM       PMAX        XPM     DPMAX      XDPM      TPMAX      XTPM
.1000       4.  3.265E+06      574. 8.444E+06      574. 1.171E+07      574.
          PEAK      XPEAK     DPPEAK    XDPEAK
     2.406E+06 4.464E+02 0.        0.
     2.526E+06 2.479E+02 0.        0.
```

AFWL HULL Calculation of 1 MT at 500 Feet Precursed Case

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PROBLEM NUMBER           13.0048
PRESSURE IN PASCALS      DISTANCE IN METERS

 TIME     DXPM       PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.1100       4.  2.966E+06     598.  6.915E+06     598.  9.881E+06      598.
          PEAK      XPEAK      DPPEAK    XDPEAK
     2.096E+06  4.624E+02  0.          0.
     2.233E+06  2.774E+02  0.          0.
 TIME     DXPM       PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.1200       5.  2.623E+06     620.  5.465E+06     625.  8.087E+06      620.
          PEAK      XPEAK      DPPEAK    XDPEAK
     1.850E+06  4.766E+02  0.          0.
     1.994E+06  3.084E+02  0.          0.
 TIME     DXPM       PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.1300       5.  2.415E+06     643.  4.586E+06     648.  6.996E+06      643.
          PEAK      XPEAK      DPPEAK    XDPEAK
     1.654E+06  4.905E+02  0.          0.
     1.820E+06  3.358E+02  0.          0.
 TIME     DXPM       PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.1400       9.  2.200E+06     665.  3.861E+06     665.  6.061E+06      665.
          PEAK      XPEAK      DPPEAK    XDPEAK
     1.484E+06  5.092E+02  2.776E+06  6.192E+02
     1.852E+06  3.532E+02  0.          0.
 TIME     DXPM       PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.1500       9.  1.903E+06     683.  3.117E+06     683.  5.020E+06      683.
          PEAK      XPEAK      DPPEAK    XDPEAK
     1.344E+06  5.183E+02  2.378E+06  6.284E+02
     1.729E+06  3.899E+02  4.103E+05  3.991E+02
 TIME     DXPM       PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.1600       9.  1.748E+06     702.  2.791E+06     702.  4.540E+06      702.
          PEAK      XPEAK      DPPEAK    XDPEAK
     1.230E+06  5.275E+02  2.081E+06  6.284E+02
     1.587E+06  4.266E+02  4.088E+05  4.266E+02
 TIME     DXPM       PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.1700       9.  1.616E+06     720.  2.557E+06     720.  4.173E+06      720.
          PEAK      XPEAK      DPPEAK    XDPEAK
     1.141E+06  5.367E+02  1.849E+06  6.376E+02
     1.449E+06  4.541E+02  4.043E+05  4.541E+02
 TIME     DXPM       PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.1800       9.  1.501E+06     729.  2.362E+06     739.  3.843E+06      739.
          PEAK      XPEAK      DPPEAK    XDPEAK
     1.323E+06  4.816E+02  1.666E+06  6.468E+02
     6.033E+05  4.587E+00  4.148E+05  4.908E+02
 TIME     DXPM       PMAX      XPM      DPMAX      XDPM      TPMAX      XTPM
.1855       9.  1.439E+06     739.  2.248E+06     748.  3.668E+06      748.
          PEAK      XPEAK      DPPEAK    XDPEAK
     1.260E+06  4.908E+02  1.583E+06  6.559E+02
     6.545E+05  4.587E+00  4.315E+05  5.092E+02
```

AFWL HULL Calculation of 1 MT at 500 Feet Precursed Case

PROBLEM NUMBER 13.0048
PRESSURE IN PASCALS DISTANCE IN METERS

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .1900 | 9. | 1.396E+06 | 748. | 2.179E+06 | 757. | 3.527E+06 | 757. |

| PEAK | XPEAK | DPPEAK | XDPEAK |
|---|---|---|---|
| 1.224E+06 | 5.092E+02 | 1.523E+06 | 6.559E+02 |
| 6.834E+05 | 4.587E+00 | 0. | 0. |

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .2000 | 9. | 1.294E+06 | 766. | 1.983E+06 | 775. | 3.204E+06 | 775. |

| PEAK | XPEAK | DPPEAK | XDPEAK |
|---|---|---|---|
| 1.149E+06 | 5.367E+02 | 1.406E+06 | 6.651E+02 |
| 7.633E+05 | 4.587E+00 | 0. | 0. |

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .2100 | 9. | 1.200E+06 | 784. | 1.745E+06 | 794. | 2.924E+06 | 784. |

| PEAK | XPEAK | DPPEAK | XDPEAK |
|---|---|---|---|
| 1.089E+06 | 5.550E+02 | 1.312E+06 | 6.835E+02 |
| 8.326E+05 | 4.587E+00 | 0. | 0. |

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PROBLEM NUMBER            13.0059
PRESSURE IN PASCALS       DISTANCE IN METERS

  TIME     DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX       XTPM
 .0103        2.-1.013E+05        239. 1.571E-05          1. 0.                   0.
           PEAK     XPEAK          DPPEAK     XDPEAK
    0.          0.           4.786E-06 2.370E+02
    0.          0.           0.         0.
  TIME     DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX       XTPM
 .0110        2. 1.123E+03        239. 2.383E-06        201. 1.123E+03       239.
           PEAK     XPEAK          DPPEAK     XDPEAK
    0.          0.           2.959E-07 1.000E+00
    0.          0.           0.         0.
  TIME     DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX       XTPM
 .0120        2. 1.123E+03        239. 2.033E-05        157. 1.123E+03       239.
           PEAK     XPEAK          DPPEAK     XDPEAK
    0.          0.           0.         0.
    0.          0.           0.         0.
  TIME     DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX       XTPM
 .0130        2. 1.123E+03        239. 6.006E-05        153. 1.123E+03       239.
           PEAK     XPEAK          DPPEAK     XDPEAK
    0.          0.           5.554E-05 2.010E+02
    0.          0.           0.         0.
  TIME     DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX       XTPM
 .0140        2. 1.123E+03        239. 1.202E-04        153. 1.123E+03       239.
           PEAK     XPEAK          DPPEAK     XDPEAK
    0.          0.           1.102E-04 2.010E+02
    0.          0.           0.         0.
  TIME     DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX       XTPM
 .0150        2. 1.123E+03        239. 1.991E-04        153. 1.123E+03       239.
           PEAK     XPEAK          DPPEAK     XDPEAK
    0.          0.           1.825E-04 2.010E+02
    0.          0.           0.         0.
  TIME     DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX       XTPM
 .0160        2. 2.536E+07          1. 6.093E+07          1. 8.629E+07         1.
           PEAK     XPEAK          DPPEAK     XDPEAK
    0.          0.           0.         0.
    0.          0.           0.         0.
  TIME     DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX       XTPM
 .0163        1. 9.380E+07          1. 1.601E+08          1. 2.539E+08         1.
           PEAK     XPEAK          DPPEAK     XDPEAK
     8.835E+07 7.322E+00 1.543E+08 7.322E+00
    0.          0.           0.         0.
  TIME     DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX       XTPM
 .0170        1. 3.031E+08          2. 1.690E+08         37. 3.440E+08        25.
           PEAK     XPEAK          DPPEAK     XDPEAK
    0.          0.           0.         0.
    0.          0.           0.         0.
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AFWL HULL Calculation of 1 MT at 750 Feet HOB - Precursed Case

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PROBLEM NUMBER             13.0059
PRESSURE IN PASCALS        DISTANCE IN METERS

 TIME      DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX        XTPM
.0180        1.  2.948E+08         45.  1.653E+08         61.  3.432E+08          54.
          PEAK       XPEAK       DPPEAK      XDPEAK
    1.301E+08  6.684E+00  0.              0.
    0.         0.         0.              0.
 TIME      DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX        XTPM
.0190        1.  2.789E+08         67.  1.636E+08         79.  3.480E+08          70.
          PEAK       XPEAK       DPPEAK      XDPEAK
    1.463E+08  3.685E+01  1.821E+07  4.978E+01
    0.         0.         0.              0.
 TIME      DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX        XTPM
.0200        1.  2.610E+08         84.  1.632E+08         91.  3.552E+08          86.
          PEAK       XPEAK       DPPEAK      XDPEAK
    1.345E+08  6.271E+01  2.699E+07  6.990E+01
    5.533E+07  5.247E+00  0.              0.
 TIME      DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX        XTPM
.0210        2.  2.337E+08         98.  1.376E+08        105.  3.355E+08          98.
          PEAK       XPEAK       DPPEAK      XDPEAK
    1.173E+08  8.107E+01  0.              0.
    0.         0.         0.              0.
 TIME      DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX        XTPM
.0230        2.  1.944E+08        121.  1.429E+08        125.  3.244E+08         121.
          PEAK       XPEAK       DPPEAK      XDPEAK
    1.041E+08  1.067E+02  4.718E+07  1.104E+02
    0.         0.         0.              0.
 TIME      DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX        XTPM
.0250        2.  1.605E+08        140.  1.379E+08        142.  2.913E+08         140.
          PEAK       XPEAK       DPPEAK      XDPEAK
    8.865E+07  1.295E+02  0.              0.
    0.         0.         0.              0.
 TIME      DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX        XTPM
.0260        2.  1.396E+08        148.  1.361E+08        150.  2.731E+08         150.
          PEAK       XPEAK       DPPEAK      XDPEAK
    8.280E+07  1.375E+02  0.              0.
    0.         0.         0.              0.
 TIME      DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX        XTPM
.0280        2.  1.186E+08        164.  1.339E+08        164.  2.525E+08         164.
          PEAK       XPEAK       DPPEAK      XDPEAK
    7.440E+07  1.557E+02  0.              0.
    0.         0.         0.              0.
 TIME      DXPM        PMAX        XPM      DPMAX        XDPM       TPMAX        XTPM
.0300        2.  9.631E+07        177.  1.218E+08        177.  2.182E+08         177.
          PEAK       XPEAK       DPPEAK      XDPEAK
    0.         0.         0.              0.
    0.         0.         0.              0.
```

AFWL HULL Calculation of 1 MT at 750 Feet HOB - Precursed Case

```
PROBLEM NUMBER          13.0059
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME     DXPM       PMAX       XPM      DPMAX       XDPM     TPMAX      XTPM
.0320       2.  8.009E+07      189.  1.157E+08      189.  1.958E+08     189.
          PEAK      XPEAK            DPPEAK     XDPEAK
   0.             0.         0.          0.
   0.             0.         0.          0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM     TPMAX      XTPM
.0335       2.  7.098E+07      197.  1.189E+08      199.  1.886E+08     199.
          PEAK      XPEAK            DPPEAK     XDPEAK
   0.             0.         0.          0.
   0.             0.         0.          0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM     TPMAX      XTPM
.0340       2.  6.913E+07      201.  1.200E+08      201.  1.892E+08     201.
          PEAK      XPEAK            DPPEAK     XDPEAK
   0.             0.         0.          0.
   0.             0.         0.          0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM     TPMAX      XTPM
.0360       2.  6.078E+07      211.  1.225E+08      211.  1.833E+08     211.
          PEAK      XPEAK            DPPEAK     XDPEAK
   0.             0.         0.          0.
   0.             0.         0.          0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM     TPMAX      XTPM
.0380       2.  5.324E+07      219.  1.202E+08      221.  1.729E+08     221.
          PEAK      XPEAK            DPPEAK     XDPEAK
   0.             0.         0.          0.
   0.             0.         0.          0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM     TPMAX      XTPM
.0400       2.  4.802E+07      229.  1.204E+08      231.  1.651E+08     231.
          PEAK      XPEAK            DPPEAK     XDPEAK
   0.             0.         0.          0.
   0.             0.         0.          0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM     TPMAX      XTPM
.0420       2.  4.242E+07      237.  1.151E+08      239.  1.556E+08     239.
          PEAK      XPEAK            DPPEAK     XDPEAK
   0.             0.         0.          0.
   0.             0.         0.          0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM     TPMAX      XTPM
.0450       2.  3.504E+07      250.  1.040E+08      252.  1.361E+08     252.
          PEAK      XPEAK            DPPEAK     XDPEAK
   0.             0.         0.          0.
   0.             0.         0.          0.
 TIME     DXPM       PMAX       XPM      DPMAX       XDPM     TPMAX      XTPM
.0480       2.  2.999E+07      260.  9.310E+07      264.  1.196E+08     262.
          PEAK      XPEAK            DPPEAK     XDPEAK
   0.             0.         0.          0.
   0.             0.         0.          0.
```

AFWL HULL Calculation of 1 MT at 750 Feet HOB - Precursed Case

```
PROBLEM NUMBER          13.0059
PRESSURE IN PASCALS     DISTANCE IN METERS

  TIME      DXPM        PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0500        2.  2.742E+07      267. 8.645E+07      271. 1.106E+08     271.
            PEAK      XPEAK      DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME      DXPM        PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0530        2.  2.428E+07      276. 7.699E+07      283. 9.820E+07     280.
            PEAK      XPEAK      DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME      DXPM        PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0560        2.  2.223E+07      285. 7.051E+07      292. 8.933E+07     292.
            PEAK      XPEAK      DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME      DXPM        PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0600        2.  2.016E+07      297. 6.426E+07      306. 8.156E+07     303.
            PEAK      XPEAK      DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME      DXPM        PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0650        2.  1.767E+07      315. 5.813E+07      321. 7.318E+07     319.
            PEAK      XPEAK      DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME      DXPM        PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0700        2.  1.505E+07      330. 5.095E+07      337. 6.369E+07     334.
            PEAK      XPEAK      DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME      DXPM        PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0750        2.  1.267E+07      342. 4.353E+07      352. 5.406E+07     349.
            PEAK      XPEAK      DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME      DXPM        PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0800        3.  1.074E+07      357. 3.710E+07      368. 4.609E+07     365.
            PEAK      XPEAK      DPPEAK     XDPEAK
     0.          0.         2.687E+07 3.953E+02
     0.          0.         0.         0.
  TIME      DXPM        PMAX      XPM     DPMAX      XDPM      TPMAX      XTPM
 .0850        3.  9.191E+06      368. 3.179E+07      382. 3.940E+07     379.
            PEAK      XPEAK      DPPEAK     XDPEAK
   3.234E+06 4.142E+02 2.492E+07 4.115E+02
     0.          0.         0.         0.
```

AFWL HULL Calculation of 1 MT at 750 Feet HOB - Precursed Case

```
PROBLEM NUMBER           13.0059
PRESSURE IN PASCALS      DISTANCE IN METERS

 TIME     DXPM       PMAX       XPM    DPMAX       XDPM      TPMAX      XTPM
.0900       3.  7.959E+06      382. 2.725E+07      395. 3.376E+07      393.
          PEAK     XPEAK     DPPEAK    XDPEAK
     3.069E+06 4.332E+02 2.310E+07 4.305E+02
     0.        0.        0.        0.
 TIME     DXPM       PMAX       XPM    DPMAX       XDPM      TPMAX      XTPM
.0950       3.  6.926E+06      394. 2.343E+07      409. 2.905E+07      406.
          PEAK     XPEAK     DPPEAK    XDPEAK
     2.929E+06 4.507E+02 2.139E+07 4.477E+02
     0.        0.        0.        0.
 TIME     DXPM       PMAX       XPM    DPMAX       XDPM      TPMAX      XTPM
.1000       3.  6.094E+06      406. 2.035E+07      421. 2.525E+07      418.
          PEAK     XPEAK     DPPEAK    XDPEAK
     2.764E+06 4.686E+02 1.966E+07 4.627E+02
     0.        0.        0.        0.
 TIME     DXPM       PMAX       XPM    DPMAX       XDPM      TPMAX      XTPM
.1100       3.  4.843E+06      427. 1.703E+07      496. 1.958E+07      442.
          PEAK     XPEAK     DPPEAK    XDPEAK
     2.554E+06 5.015E+02 1.577E+07 4.477E+02
     0.        0.        0.        0.
 TIME     DXPM       PMAX       XPM    DPMAX       XDPM      TPMAX      XTPM
.1200       3.  3.943E+06      448. 1.461E+07      527. 1.691E+07      527.
          PEAK     XPEAK     DPPEAK    XDPEAK
     2.334E+06 5.299E+02 1.245E+07 4.706E+02
     0.        0.        0.        0.
 TIME     DXPM       PMAX       XPM    DPMAX       XDPM      TPMAX      XTPM
.1300       4.  3.297E+06      468. 1.272E+07      555. 1.486E+07      555.
          PEAK     XPEAK     DPPEAK    XDPEAK
     2.160E+06 5.588E+02 1.012E+07 4.934E+02
     1.724E+06 2.164E+01 0.        0.
 TIME     DXPM       PMAX       XPM    DPMAX       XDPM      TPMAX      XTPM
.1400       4.  2.804E+06      486. 1.103E+07      581. 1.300E+07      584.
          PEAK     XPEAK     DPPEAK    XDPEAK
     1.980E+06 5.878E+02 8.330E+06 5.152E+02
     3.942E+05 2.504E+02 0.        0.
 TIME     DXPM       PMAX       XPM    DPMAX       XDPM      TPMAX      XTPM
.1500       4.  2.433E+06      501. 9.765E+06      610. 1.161E+07      610.
          PEAK     XPEAK     DPPEAK    XDPEAK
     1.853E+06 6.132E+02 7.002E+06 5.333E+02
     4.914E+05 2.647E+02 0.        0.
 TIME     DXPM       PMAX       XPM    DPMAX       XDPM      TPMAX      XTPM
.1600       4.  2.141E+06      516. 8.500E+06      634. 1.019E+07      634.
          PEAK     XPEAK     DPPEAK    XDPEAK
     1.689E+06 6.342E+02 5.946E+06 5.543E+02
     1.906E+06 9.819E+01 0.        0.
```

AFWL HULL Calculation of 1 MT at 750 Feet HOB - Precursed Case

```
PROBLEM NUMBER            13.0059
PRESSURE IN PASCALS       DISTANCE IN METERS

  TIME     DXPM        PMAX       XPM      DPMAX       XDPM       TPMAX       XTPM
 .1700       4.  1.907E+06      533.  7.591E+06       655.  9.152E+06       655.
           PEAK      XPEAK     DPPEAK     XDPEAK
      1.588E+06  6.594E+02  5.119E+06  5.711E+02
      1.861E+06  3.996E+01  0.         0.
  TIME     DXPM        PMAX       XPM      DPMAX       XDPM       TPMAX       XTPM
 .1800      16.  1.722E+06       76.  6.766E+06       677.  8.223E+06       677.
           PEAK      XPEAK     DPPEAK     XDPEAK
      1.484E+06  6.822E+02  4.474E+06  5.897E+02
      1.714E+06  5.460E+02  0.         0.
  TIME     DXPM        PMAX       XPM      DPMAX       XDPM       TPMAX       XTPM
 .1900      15.  1.595E+06      107.  6.009E+06       702.  7.373E+06       702.
           PEAK      XPEAK     DPPEAK     XDPEAK
      1.367E+06  7.065E+02  3.936E+06  6.092E+02
      1.554E+06  5.606E+02  0.         0.
  TIME     DXPM        PMAX       XPM      DPMAX       XDPM       TPMAX       XTPM
 .2000      14.  1.489E+06      136.  5.455E+06       721.  6.740E+06       721.
           PEAK      XPEAK     DPPEAK     XDPEAK
      1.301E+06  7.260E+02  3.500E+06  6.238E+02
      1.422E+06  5.752E+02  0.         0.
  TIME     DXPM        PMAX       XPM      DPMAX       XDPM       TPMAX       XTPM
 .2100      14.  1.375E+06      150.  4.934E+06       741.  6.158E+06       745.
           PEAK      XPEAK     DPPEAK     XDPEAK
      1.224E+06  7.454E+02  3.142E+06  6.384E+02
      1.306E+06  5.897E+02  0.         0.
  TIME     DXPM        PMAX       XPM      DPMAX       XDPM       TPMAX       XTPM
 .2300      11.  1.126E+06      193.  4.029E+06       782.  5.090E+06       782.
           PEAK      XPEAK     DPPEAK     XDPEAK
      1.062E+06  7.872E+02  2.573E+06  6.689E+02
      1.115E+06  6.126E+02  0.         0.
  TIME     DXPM        PMAX       XPM      DPMAX       XDPM       TPMAX       XTPM
 .2401       6.  1.038E+06      624.  3.730E+06       798.  4.746E+06       798.
           PEAK      XPEAK     DPPEAK     XDPEAK
      1.023E+06  8.041E+02  2.350E+06  6.858E+02
      1.024E+06  2.264E+02  0.         0.
```

AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Precursed Case

PROBLEM NUMBER 13.0060
PRESSURE IN PASCALS DISTANCE IN METERS

| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
|---|---|---|---|---|---|---|---|
| .0120 | 2. | -1.013E+05 | 239. | 6.801E-06 | 139. | 0. | 0. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 0. | 0. | 0. | 0. | | | |
| | 0. | 0. | 0. | 0. | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0130 | 2. | 1.123E+03 | 280. | 8.996E-06 | 221. | 1.123E+03 | 280. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 1.122E+03 | 2.188E+02 | 3.166E-06 | 5.882E-06 | | | |
| | 0. | 0. | 4.930E-06 | 2.165E+02 | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0140 | 2. | 1.123E+03 | 280. | 4.231E-05 | 226. | 1.123E+03 | 280. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 1.122E+03 | 2.235E+02 | 1.738E-05 | 3.077E-05 | | | |
| | 0. | 0. | 2.431E-05 | 1.772E-05 | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0150 | 2. | 1.123E+03 | 280. | 1.017E-04 | 228. | 1.123E+03 | 280. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 1.122E+03 | 2.258E+02 | 4.393E-05 | 5.578E-05 | | | |
| | 0. | 0. | 7.424E-05 | 1.439E+02 | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0160 | 2. | 1.123E+03 | 280. | 1.733E-04 | 233. | 1.123E+03 | 280. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 1.122E+03 | 2.305E+02 | 8.384E-05 | 1.135E-04 | | | |
| | 0. | 0. | 1.355E-04 | 1.439E+02 | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0170 | 2. | 1.123E+03 | 280. | 2.699E-04 | 235. | 1.123E+03 | 280. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 1.122E+03 | 2.329E+02 | 1.379E-04 | 1.903E-04 | | | |
| | 0. | 0. | 2.143E-04 | 1.904E-04 | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0180 | 2. | 1.123E+03 | 280. | 3.838E-04 | 238. | 1.123E+03 | 280. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 1.122E+03 | 2.352E+02 | 2.071E-04 | 3.006E-04 | | | |
| | 0. | 0. | 3.238E-04 | 3.001E-04 | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0190 | 2. | 1.123E+03 | 280. | 7.938E-03 | 48. | 1.123E+03 | 280. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 1.122E+03 | 2.390E+02 | 5.390E-03 | 7.565E-03 | | | |
| | 0. | 0. | 7.563E-03 | 5.355E-03 | | | |
| TIME | DXPM | PMAX | XPM | DPMAX | XDPM | TPMAX | XTPM |
| .0200 | 2. | 1.123E+03 | 280. | 1.591E-01 | 48. | 1.123E+03 | 280. |
| | PEAK | XPEAK | DPPEAK | XDPEAK | | | |
| | 1.122E+03 | 2.422E+02 | 1.406E-01 | 1.536E-01 | | | |
| | 9.983E+02 | 3.861E+01 | 1.474E-01 | 1.558E-01 | | | |

AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Precursed Case

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PROBLEM NUMBER          13.0060
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX      XTPM
.0210        2.  1.123E+03       280. 7.063E-01        48. 1.123E+03      280.
           PEAK       XPEAK     DPPEAK     XDPEAK
      1.122E+03 2.446E+02 6.377E-01 6.744E-01
      6.776E+02 3.861E+01 6.551E-01 6.916E-01
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX      XTPM
.0230        2.  1.123E+03       280. 2.324E+00       137. 1.123E+03      280.
           PEAK       XPEAK     DPPEAK     XDPEAK
      1.122E+03 2.492E+02 2.279E+00 2.267E+00
     -4.476E+02 3.861E+01 2.283E+00 2.237E+00
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX      XTPM
.0250        3.  1.123E+03       308. 1.597E+00       141. 1.123E+03      308.
           PEAK       XPEAK     DPPEAK     XDPEAK
      1.122E+03 2.541E+02 1.208E+00 1.219E+00
     -1.698E+03 2.967E+01 1.212E+00 1.220E+00
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX      XTPM
.0260        3.  1.123E+03       308. 2.218E+00       151. 1.123E+03      308.
           PEAK       XPEAK     DPPEAK     XDPEAK
      1.122E+03 2.567E+02 5.297E-01 2.817E-01
     -2.128E+03 1.303E+02 2.855E-01 2.811E-01
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX      XTPM
.0280        3.  1.123E+03       308. 7.410E+00        30. 1.123E+03      308.
           PEAK       XPEAK     DPPEAK     XDPEAK
      1.122E+03 2.619E+02 4.513E+00 5.773E+00
      6.006E+02 1.432E+02 5.610E+00 5.935E+00
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX      XTPM
.0300        3.  1.123E+03       308. 6.936E+00       143. 1.123E+03      308.
           PEAK       XPEAK     DPPEAK     XDPEAK
      1.122E+03 2.670E+02 6.312E+00 6.102E+00
     -1.328E+03 1.484E+02 6.680E+00 5.490E+00
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX      XTPM
.0320        2.  1.148E+03       140. 7.005E+00       151. 1.148E+03      140.
           PEAK       XPEAK     DPPEAK     XDPEAK
      1.122E+03 2.670E+02 5.614E+00 1.462E+02
     -5.138E+02 1.462E+02 0.        0.
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX      XTPM
.0340        6.  6.060E+07         3. 5.856E+07        15. 1.175E+08        3.
           PEAK       XPEAK     DPPEAK     XDPEAK
      0.        0.        0.        0.
      0.        0.        0.        0.
 TIME      DXPM        PMAX        XPM      DPMAX      XDPM      TPMAX      XTPM
.0360        2.  1.249E+08        49. 6.035E+07        68. 1.388E+08       56.
           PEAK       XPEAK     DPPEAK     XDPEAK
      5.118E+07 8.953E+00 0.        0.
      5.059E+07 2.578E+00 0.        0.
```

AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Precursed Case

```
PROBLEM NUMBER           13.0060
PRESSURE IN PASCALS      DISTANCE IN METERS

  TIME      DXPM       PMAX       XPM      DPMAX      XDPM     TPMAX       XTPM
 .0380        2. 1.130E+08       82. 5.738E+07       94. 1.362E+08        86.
            PEAK      XPEAK     DPPEAK     XDPEAK
       5.676E+07 5.160E+01 5.741E+06 6.373E+01
       3.249E+07 1.493E+00 0.        0.
  TIME      DXPM       PMAX       XPM      DPMAX      XDPM     TPMAX       XTPM
 .0400        2. 1.033E+08      106. 5.311E+07      114. 1.324E+08       108.
            PEAK      XPEAK     DPPEAK     XDPEAK
       5.301E+07 8.395E+01 9.003E+06 9.203E+01
       3.216E+07 4.958E+01 0.        0.
  TIME      DXPM       PMAX       XPM      DPMAX      XDPM     TPMAX       XTPM
 .0416        2. 9.416E+07      122. 5.059E+07      128. 1.284E+08       122.
            PEAK      XPEAK     DPPEAK     XDPEAK
       5.073E+07 1.042E+02 1.169E+07 1.082E+02
       3.077E+07 7.991E+01 0.        0.
  TIME      DXPM       PMAX       XPM      DPMAX      XDPM     TPMAX       XTPM
 .0420        2. 9.278E+07      124. 4.944E+07      130. 1.276E+08       126.
            PEAK      XPEAK     DPPEAK     XDPEAK
       5.024E+07 1.082E+02 1.215E+07 1.123E+02
       3.050E+07 8.395E+01 0.        0.
  TIME      DXPM       PMAX       XPM      DPMAX      XDPM     TPMAX       XTPM
 .0450        2. 7.675E+07      148. 4.207E+07      152. 1.137E+08       148.
            PEAK      XPEAK     DPPEAK     XDPEAK
       4.425E+07 1.336E+02 1.563E+07 1.359E+02
       2.855E+07 1.172E+02 0.        0.
  TIME      DXPM       PMAX       XPM      DPMAX      XDPM     TPMAX       XTPM
 .0480        2. 6.497E+07      169. 4.160E+07      169. 1.066E+08       169.
            PEAK      XPEAK     DPPEAK     XDPEAK
       4.051E+07 1.570E+02 1.929E+07 1.570E+02
       0.        0.        0.        0.
  TIME      DXPM       PMAX       XPM      DPMAX      XDPM     TPMAX       XTPM
 .0500        2. 5.916E+07      180. 4.179E+07      180. 1.010E+08       180.
            PEAK      XPEAK     DPPEAK     XDPEAK
       3.800E+07 1.687E+02 2.089E+07 1.710E+02
       0.        0.        0.        0.
  TIME      DXPM       PMAX       XPM      DPMAX      XDPM     TPMAX       XTPM
 .0530        3. 4.916E+07      195. 3.899E+07      195. 8.815E+07       195.
            PEAK      XPEAK     DPPEAK     XDPEAK
       3.424E+07 1.874E+02 0.        0.
       0.        0.        0.        0.
  TIME      DXPM       PMAX       XPM      DPMAX      XDPM     TPMAX       XTPM
 .0560        3. 4.346E+07      211. 4.019E+07      211. 8.365E+07       211.
            PEAK      XPEAK     DPPEAK     XDPEAK
       0.        0.        0.        0.
       0.        0.        0.        0.
```

AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Precursed Case

```
PROBLEM NUMBER          13.0060
PRESSURE IN PASCALS     DISTANCE IN METERS

  TIME    DXPM      PMAX      XPM     DPMAX     XDPM     TPMAX      XTPM
 .0600      3. 3.675E+07     229. 4.105E+07     229. 7.780E+07     229.
          PEAK     XPEAK    DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME    DXPM      PMAX      XPM     DPMAX     XDPM     TPMAX      XTPM
 .0650      3. 2.989E+07     247. 4.070E+07     247. 7.060E+07     247.
          PEAK     XPEAK    DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME    DXPM      PMAX      XPM     DPMAX     XDPM     TPMAX      XTPM
 .0700      3. 2.594E+07     265. 4.349E+07     267. 6.792E+07     265.
          PEAK     XPEAK    DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME    DXPM      PMAX      XPM     DPMAX     XDPM     TPMAX      XTPM
 .0750      3. 2.165E+07     280. 4.453E+07     283. 6.571E+07     283.
          PEAK     XPEAK    DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME    DXPM      PMAX      XPM     DPMAX     XDPM     TPMAX      XTPM
 .0781      3. 1.988E+07     292. 4.430E+07     292. 6.417E+07     292.
          PEAK     XPEAK    DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME    DXPM      PMAX      XPM     DPMAX     XDPM     TPMAX      XTPM
 .0800      3. 1.890E+07     295. 4.422E+07     298. 6.301E+07     298.
          PEAK     XPEAK    DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME    DXPM      PMAX      XPM     DPMAX     XDPM     TPMAX      XTPM
 .0850      3. 1.657E+07     309. 4.288E+07     312. 5.883E+07     312.
          PEAK     XPEAK    DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME    DXPM      PMAX      XPM     DPMAX     XDPM     TPMAX      XTPM
 .0900      3. 1.431E+07     322. 3.986E+07     328. 5.237E+07     325.
          PEAK     XPEAK    DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
  TIME    DXPM      PMAX      XPM     DPMAX     XDPM     TPMAX      XTPM
 .0950      3. 1.265E+07     334. 3.688E+07     340. 4.825E+07     340.
          PEAK     XPEAK    DPPEAK     XDPEAK
     0.          0.         0.         0.
     0.          0.         0.         0.
```

AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Precursed Case

```
PROBLEM NUMBER          13.0060
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME      DXPM        PMAX        XPM     DPMAX       XDPM     TPMAX       XTPM
.1000        3.  1.131E+07        346.  3.364E+07      355.  4.376E+07      352.
           PEAK       XPEAK       DPPEAK     XDPEAK
    0.          0.          0.          0.
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX       XDPM     TPMAX       XTPM
.1100        3.  9.186E+06        369.  2.777E+07      379.  3.564E+07      376.
           PEAK       XPEAK       DPPEAK     XDPEAK
    0.          0.          0.          0.
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX       XDPM     TPMAX       XTPM
.1200        3.  7.768E+06        388.  2.362E+07      401.  3.009E+07      398.
           PEAK       XPEAK       DPPEAK     XDPEAK
    0.          0.          0.          0.
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX       XDPM     TPMAX       XTPM
.1300        4.  6.656E+06        407.  1.972E+07      421.  2.518E+07      418.
           PEAK       XPEAK       DPPEAK     XDPEAK
    0.          0.          0.          0.
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX       XDPM     TPMAX       XTPM
.1400        4.  5.986E+06        429.  1.755E+07      443.  2.252E+07      440.
           PEAK       XPEAK       DPPEAK     XDPEAK
    0.          0.          0.          0.
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX       XDPM     TPMAX       XTPM
.1500        4.  5.396E+06        447.  1.594E+07      461.  2.037E+07      458.
           PEAK       XPEAK       DPPEAK     XDPEAK
    0.          0.          0.          0.
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX       XDPM     TPMAX       XTPM
.1600        4.  4.762E+06        465.  1.418E+07      480.  1.808E+07      476.
           PEAK       XPEAK       DPPEAK     XDPEAK
    0.          0.          0.          0.
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX       XDPM     TPMAX       XTPM
.1700        4.  4.169E+06        484.  1.257E+07      499.  1.597E+07      495.
           PEAK       XPEAK       DPPEAK     XDPEAK
    1.295E+06   5.489E+02   9.325E+06   5.450E+02
    0.          0.          0.          0.
 TIME      DXPM        PMAX        XPM     DPMAX       XDPM     TPMAX       XTPM
.1800        4.  3.642E+06        501.  1.108E+07      521.  1.403E+07      517.
           PEAK       XPEAK       DPPEAK     XDPEAK
    1.237E+06   5.732E+02   8.800E+06   5.692E+02
    0.          0.          0.          0.
```

AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Precursed Case

```
PROBLEM NUMBER          13.0060
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.1900       4. 3.205E+06     517. 9.769E+06     537. 1.235E+07      533.
          PEAK     XPEAK     DPPEAK    XDPEAK
     1.170E+06 6.013E+02 8.227E+06 5.933E+02
     0.        0.        0.        0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.2000       4. 2.839E+06     533. 8.633E+06     557. 1.088E+07      549.
          PEAK     XPEAK     DPPEAK    XDPEAK
     1.122E+06 6.253E+02 7.768E+06 6.173E+02
     0.        0.        0.        0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.2100       4. 2.523E+06     547. 7.613E+06     574. 9.599E+06      569.
          PEAK     XPEAK     DPPEAK    XDPEAK
     1.068E+06 6.443E+02 7.274E+06 6.399E+02
     0.        0.        0.        0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.2300       4. 2.046E+06     578. 6.387E+06     684. 7.671E+06      600.
          PEAK     XPEAK     DPPEAK    XDPEAK
     9.760E+05 6.884E+02 6.077E+06 6.046E+02
     1.548E+05 2.603E+02 0.        0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.2500       5. 1.700E+06     603. 5.588E+06     725. 6.467E+06      725.
          PEAK     XPEAK     DPPEAK    XDPEAK
     8.869E+05 7.298E+02 4.939E+06 6.373E+02
     6.950E+05 9.199E+00 0.        0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.2530       5. 1.657E+06     608. 5.477E+06     730. 6.338E+06      730.
          PEAK     XPEAK     DPPEAK    XDPEAK
     8.745E+05 7.346E+02 4.796E+06 6.422E+02
     7.151E+05 9.199E+00 0.        0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.2600       5. 1.564E+06     618. 5.249E+06     744. 6.088E+06      744.
          PEAK     XPEAK     DPPEAK    XDPEAK
     8.521E+05 7.492E+02 4.504E+06 6.519E+02
     7.629E+05 9.199E+00 0.        0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.2800       6. 1.343E+06     643. 4.650E+06     784. 5.431E+06      784.
          PEAK     XPEAK     DPPEAK    XDPEAK
     7.952E+05 7.897E+02 3.776E+06 6.771E+02
     8.143E+05 1.034E+01 0.        0.
 TIME     DXPM       PMAX       XPM     DPMAX      XDPM      TPMAX      XTPM
.3000       6. 1.167E+06     666. 4.101E+06     818. 4.800E+06      818.
          PEAK     XPEAK     DPPEAK    XDPEAK
     7.126E+05 8.235E+02 3.208E+06 7.052E+02
     8.156E+05 1.034E+01 0.        0.
```

AFWL HULL Calculation of 1 MT at 1000 Feet HOB - Precursed Case

```
PROBLEM NUMBER          13.0060
PRESSURE IN PASCALS     DISTANCE IN METERS

 TIME      DXPM       PMAX        XPM     DPMAX        XDPM      TPMAX       XTPM
.3200        6.  1.029E+06       688.  3.676E+06       852.  4.326E+06       857.
           PEAK      XPEAK     DPPEAK    XDPEAK
      6.586E+05  8.629E+02  2.770E+06  7.334E+02
      7.656E+05  1.034E+01  0.         0.
 TIME      DXPM       PMAX        XPM     DPMAX        XDPM      TPMAX       XTPM
.3400        6.  9.219E+05       709.  3.291E+06       889.  3.890E+06       889.
           PEAK      XPEAK     DPPEAK    XDPEAK
      6.000E+05  8.955E+02  2.412E+06  7.527E+02
      6.789E+05  7.685E+01  0.         0.
 TIME      DXPM       PMAX        XPM     DPMAX        XDPM      TPMAX       XTPM
.3600        6.  8.313E+05       728.  2.986E+06       920.  3.543E+06       920.
           PEAK      XPEAK     DPPEAK    XDPEAK
      5.660E+05  9.265E+02  2.132E+06  7.775E+02
      6.177E+05  1.556E+02  0.         0.
 TIME      DXPM       PMAX        XPM     DPMAX        XDPM      TPMAX       XTPM
.3800        6.  7.530E+05       746.  2.712E+06       951.  3.230E+06       958.
           PEAK      XPEAK     DPPEAK    XDPEAK
      5.263E+05  9.576E+02  1.909E+06  8.024E+02
      5.737E+05  1.916E+02  0.         0.
 TIME      DXPM       PMAX        XPM     DPMAX        XDPM      TPMAX       XTPM
.4000        7.  6.893E+05       767.  2.487E+06       983.  2.979E+06       983.
           PEAK      XPEAK     DPPEAK    XDPEAK
      4.974E+05  9.903E+02  1.715E+06  8.250E+02
      5.378E+05  2.163E+02  0.         0.
```

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